RAILROAD GAZETTE

FRIDAY, APRIL 8, 1904.

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Contributions

A Tonnage Rating Formula.

Philadelphia, Pa., March 26, 1904.

To the Editor of The Railroad Gazette:

In your issue of March 25 I notice a letter by Mr. A. L. Kuehn on "Tonnage Rating on a Combined Car and Tonnage Basis." The principles enumerated are no doubt correct, and call to mind a formula presented by the undersigned to the Western Railway Club last year in a discussion on Mr. Wickhorst's paper on "Equated Tonnage Rates." This formula was prepared to take into consideration the number of cars as well as the number of tons in a train back of the engine, and is as follows:

Let R = the resistance of train or pull at tender drawbar in pounds.

T = the number of tons back of tender, including cars and contents.

C = the number of cars in train.

Then for slow speeds (up to 12 miles an hour) and on level track we have $R = 3.5\ T + 50\ C$. On grades, the coefficient of T must be increased by 20 times the per cent. of grade; thus on a 1 per cent. grade $R = 23.5\ T + 50\ C$.

If we know the tractive force of any engine available back of tender on the ruling grade of, say, 1 per cent., it is a simple process to take enough cars with their lading so that $23.5\ T + 50\ C$ just equals that tractive force. The weight of cars and number in a train are always known and no other factors are needed, but the coefficient of T for the ruling grade. Tables can be prepared on this basis, if desired, giving the data in the form shown by Mr. Kuehn.

We find from this formula that the resistance of empties of 16⅔ tons each car of cars weighing 33⅓ tons gross and also 50 tons gross will be as follows:

100 tons of 6 — 16⅔ ton cars, $R = 3.5 \times 100 + 50 \times 6 =$ 650 pounds.

100 tons of 3 — 33⅓ ton cars, $R = 3.5 \times 100 + 50 \times 3 =$ 500 pounds.

100 tons of 2 — 50 ton cars, $R = 3.5 \times 100 + 50 \times 2 =$ 450 pounds.

Or 6.5, 5 and 4.5 pounds per ton respectively, which agrees well with current practice for equating tonnage trains on a level.

A diagram or chart was also presented at the same time showing a quick method of determining the intermediate combinations of load and cars when the proper weight in 16⅔ and also in 50-ton cars was given as the engine rating, and this chart is available for any size or combination of cars and loads, and gives, without calculation, the combinations of cars and tons that produce the same drawbar pull.

G. R. Henderson.

Is the "19" Form of Train-Order Unsafe?

BY H. W. FORMAN.

In Government Accident Bulletin No. 9, item 29 (*Railroad Gazette*, Feb. 26, page 142) the following explanation of a collision is found: "They had a 19 order against Second No. 1, but read it No. 1; engineman was killed. Being on Form 19 the order was not read by the operator to the conductor and engineman." Stress appears to be laid upon the fact that being a "19" it was not read aloud by the operator to the conductor and engineman, and that had this been done the collision might not have occurred. It is not claimed that the order was illegible, or that it was not properly delivered into the hands of these men. Standard Code rules do not require operators, conductors or enginemen to read "31" orders to anyone.*

But what assurance have we that had the order been read to the conductor or engineman, they would not then have encroached on the time of the other train? One of two theories seems tenable; either the order was not written plainly or it was not read by all the men on the train. An operator can readily read his own writing, but it does not always follow that others can.

It has been my experience that to read an order to another interested person is fraught with great risk. The person reading is quite as likely to misread the order, and if he does he has lodged an impression in the mind of the man to whom the order is read that may govern his actions thereafter, notwithstanding he may himself afterward perfunctorily glance over the order. It has had that disastrous effect upon many who have heard orders misread.

Insure that orders can be read and understood only in one way, and that delivery has been effected, and those who are to execute them may be depended upon to carry out their provisions, provided the men be the right kind of employees, and do not forget that they possess the orders. It is not now thought to be sufficient protection to deliver copies of orders only to the conductor and engineman of a train; brakemen and firemen must be shown all orders and, if need be, must remind their conductor or engineman. It is reasonable to assume that if this were always done, and if the men are duly attentive, that all five of them will not misread a plain order and crash into an opposing superior train. It is someone's duty to see that orders are plainly written.

Does it not seem likely that there is greater danger of an operator or conductor misreading an order to other men on the train and such men acting on the order without first carefully reading it when it is delivered to them? On some roads orders for first class trains are shown only to the fireman and flagman; but the front brakeman arranges the switches for the train, is vitally interested in its precedence, and the orders should be read to him. He should know under what orders the train is moving.

In some quarters there is unwarranted fear of and opposition to the "19" form of train order. If one asks for facts demonstrating that such orders, when properly used, have caused more collisions than the "31" form, they are not forthcoming. If I were to state that there is no single movement that can be made under a "31" order which cannot be as safely made by employment of the "19" form I should be regarded as altogether too radical; still it is a fact. It is not the kind of order that causes collisions, but the method employed in making the delivery, or failure to read, understand and respect it. Suppose a train order signal be displayed at stop at D to direct No. 2, the superior train, to meet No. 1 at C, a blind siding next beyond; can it possibly make any difference whether a "19" or "31" order be addressed to No. 2? The order signal is at stop and No. 2 must not pass such station without being released. If the crew disregards the order signal a collision could result without regard to the kind of order that may be awaiting the train. If No. 2 receives the order can it possibly make any difference to the conductor and engineman whether or not they have acknowledged it? Must not it be respected? If a "31" order, and it is not delivered, what can the despatcher do to prevent a collision if No. 1 is out of reach? If the operator fails to deliver a "19," will not he at once advise the despatcher, the same as if he had failed to deliver a "31"?

The danger in "19" orders lies in their misuse, generally by reason of failure on the part of the despatcher to understand their true mission. Display an order signal at stop for both "19" and "31" orders and there is then a grave element of danger, as either will clear a train, with a clearance-card, or after delivery of one of them has been made, and the order signal is restored to proceed. But why should the despatcher run this risk? The train must stop to acknowledge the "31" order, why not get signatures to all, or surround the movement with the other safeguards known to despatchers?

To require a train to stop to sign for an order which only permits it to advance is burdensome and unnecessary. What harm can result if the order is forgotten and never delivered?

Some roads use only the "31" form, because the "19" order is considered unsafe, but it will be found that reckless practices have crept in, even on such roads. To avoid delay the operator or brakeman sometimes will sign a conductor's name to an order, and this too without the despatcher's knowledge. Such a course will at times seem necessary, but to follow it will in time result in accident; an operator may fail to deliver all the orders he has acknowledged for the conductor, or he may receipt for orders restricting a train before the conductor has had opportunity to place it on the siding, and the order may so require.

The groundless fear of the "19" order will not entirely down, but a far more dangerous condition is often tolerated without very much concern. I refer to the rule under which a restricting order is issued and only the conductor signs it, no provision being made, in the clearance-card or elsewhere, for obtaining the engineman's acknowledgment. Should the engineman overlook an order he could throw it in the fire-box and declare that the conductor had failed to deliver him that particular order. The conductor may fail to deliver an order to his engineman and take advantage of some such equivocal rule to account for the engineman failing to respect it. If the clearance-card contained the numbers of all orders delivered to a train, or if the engineman were required to sign his name on the copies retained by the conductor, there would then be a record of proper delivery to all persons interested. This plan was discussed by the American Railway Association, but not adopted. It was thought to impose too much clerical work upon the operator. A number of companies have nevertheless adopted it. It is practicable on roads which are not crowded with traffic and do not feel compelled to sacrifice precautionary measures for the sake of saving time.

Is it advisable to extend the use of the "19" form of train order, and is there a way to make it even safer than the present almost universal method of handling "31" orders? My experience with both forms prompts me to unhesitatingly answer yes, to both queries.

Issue a "31" order and secure both the conductor's and engineman's signature to meet No. 1, an inferior train, at a telegraph station beyond, possibly several stations distant, and let other matters engage the thoughts or attention of the conductor and engineman of No. 2 to such a degree that they forget these instructions, and what is gained by stopping them to secure their acknowledgment? Give a "19" order instead, addressing it to No. 2 at D, and to the operator at C, the meeting point, and what matter if every man on both trains forget? The order signal is at stop at the place of meeting and this infallible sentinel never forgets. Also, No. 2 was not delayed perhaps five minutes stopping to sign orders. Will anyone contend that two order signals against a superior train, or an inferior one for that matter, are not safer than one? Or that unless some measure of this nature is adopted, there will ever be freedom from collisions through failure to respect orders to meet? The train despatcher has done all that he can.

It will be claimed that the practice is cumbersome for the reason that there will be too many order signals at stop, thus delaying disinterested trains unnecessarily; that the work of the despatcher is increased one-fourth and that more operators would have to be employed; but this is a groundless complaint.

I have in mind a great railroad in the middle west whose general superintendent adheres to this plan notwithstanding he is a member of the Train Rule Committee of the American Railway Association. This requirement has been in effect on that road for thirty years or more, and the road has become one of the richest and most popular in the country. Its traffic is always heavy and every condition is present to give the plan a severe test. There has been no serious detention to its 12 or 16 first class, 8 or 10 second class and 30 or 40 third class daily trains on single track, and its despatchers have been able to handle reasonably long districts with about 40 orders each eight hours, which is generally conceded to be a fair day's work for a despatcher. It is true that despatchers on that road give their entire attention to the movement of trains. Can anyone show that there has ever been a butting collision on that road when the orders were issued as outlined above? Or that the company has failed to put its passenger or freight trains through satisfactorily? Have its neighbors been as fortunate? On one occasion 200 "19" orders were issued by one set of despatchers before it was found necessary to give a "31" order.

So much for the "19" order *per se*. But I cannot refrain from a few general observations, for I know that every superintendent or trainmaster or despatcher who sees this will read between the lines, and do a lot of thinking in a wider field. The fatalist, who is always with us, will probably dismiss this collision with the time-honored axioms that as long as there are railroads there will be just so many accidents, and that railroad men are much the same the world over; that the control of the personal equation is an unsolvable problem; and that if there is not alone enough guarantee in the assumption that when the lives of men are likely to be forfeited if they fail to properly execute train orders, it is useless to surround meeting orders with additional safeguards. But let us have a word with the fatalist, for he sometimes sits in a railroad director's chair.

If railroad men (commonly understood to mean conductors, brakemen, enginemen, firemen, train despatchers and operators) are much the same throughout the land, and if the standard of efficiency has not been raised during the past twelve months, are these men entirely to blame? Will not at least ninety per cent. of such employees actually retrograde if not subjected to systematic checking which will compel them to constantly study and properly understand train rules? Give some train despatchers carte-blanche to issue train orders as they please, and how long will they follow the prescribed forms?

Collisions are due, primarily, to three causes: poverty, competition, and failure to select careful and intelligent men, and to regularly and systematically instruct and examine them; also the retention of employees who are too old, and those who have clearly proved that they are unsafe. By reason of poverty, railroads continue to use antiquated order signals, inconvenient and inadequate siding facilities, heavy grades, obscure curves, and weak

*But the Standard Code, in a footnote, suggests reading by the operator to the conductor, and the codes of a number of railroads require it.—Editor.

equipment, and to do without blocking plants. Through competition, it is necessary to deliver freight within the same time that a competitive neighbor can deliver it. Roughly estimated, seventy per cent. of earnings is needed to pay the actual cost of performing the service. Therefore, if an engine can haul 1,000 tons, but because of competition, it is necessary to have it make a trip with 700 tons, the company simply presents the shipper with the service without remuneration, and the train is compelled to move at a speed and take chances that invites accident. A stock shipper will represent to an agent at a station which through torture of language may be regarded as a competitive one that he has one or two hundred cars of cattle which he has decided to ship over the road which can perform the most rapid service. He will offer each company 14 cars on a certain day provided it can be hauled by an engine having a capacity of twenty loaded cars, and that no other freight be added to such train; and the road which reaches the market first will secure the remaining hundred or so cars. Well-paying merchandise freight is sacrificed and the stock is rushed through, sometimes at an actual loss, and the other road is beaten several hours. But the rest of the cattle are seldom heard from. Had the engine been loaded to its capacity there would have been enough profit in the freight to enable the company to make some needed improvement.

A sixteen year old boy is not sufficiently matured in judgment to be entrusted with the delivery of train orders, nor should trainmen or enginemen who have reached three score and ten be depended upon to quickly grasp the meaning of such orders. Operators who cannot write plainly and the men in responsible charge of a train who either cannot or will not carefully read and fully understand plainly written train orders are factors that supply food for the fatalist's deductions.

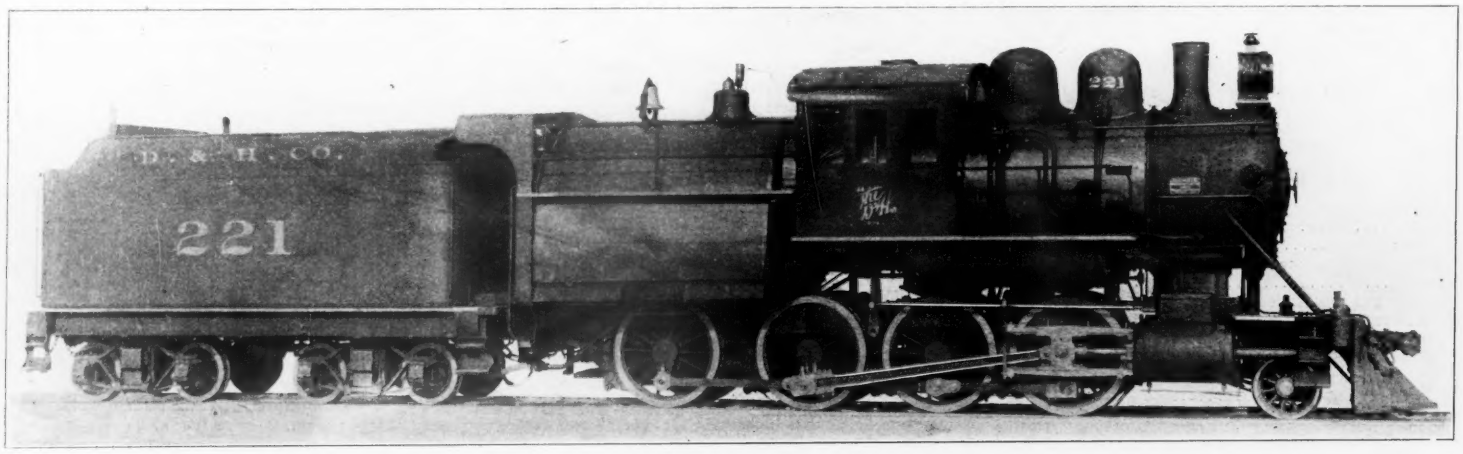
How are trainmen and operators selected and educated? A book of standard rules may have been put into effect on the A. & Z. R. R. about eight years ago, pretty thoroughly discussed at the time and all concerned examined thereon; but probably not much has been done in the way of checking up or examining the men since. Men since employed or promoted may have been taken through an examination lasting, possibly, three hours, conducted by the chief train despatcher or the assistant superintendent of the division. And possibly these examining officers came to this company only a few years before, maybe with somewhat distorted views gleaned from some former experience, but not sustained by the rules. Verily "a little learning is a dangerous thing" when applied to train rules or train despatching. When these men were examined years ago the company may have thought the matter settled for all time, and there may not have been an examination of old employees since, nor any systematic check to ascertain whether the rules were being lived up to; whether the men had formed safe habits in carefully reading train orders, refusing to act on those which were ambiguous, checking train registers, flagging, identifying trains and securing adequate rest before going out on a trip. Such things are often thought unimportant until the daily press announces in bold headlines that another sickening accident has occurred in consequence of failure to observe some such so-called trifling safety precaution.

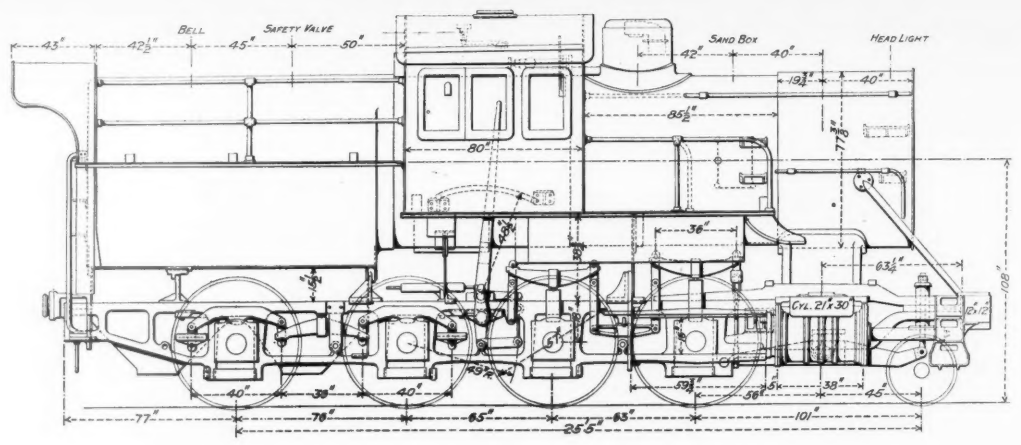
There is no getting away from these conclusions. No railroad man who is well posted tries to get away from them. Safety cannot be had without expenditure of money, and efficient trainmen and operators cannot be had without hard work on the part of the trainmaster, or some one, in educating them. The shallow reasoning of the fatalist is easily enough demolished, if we go about it in the right way.

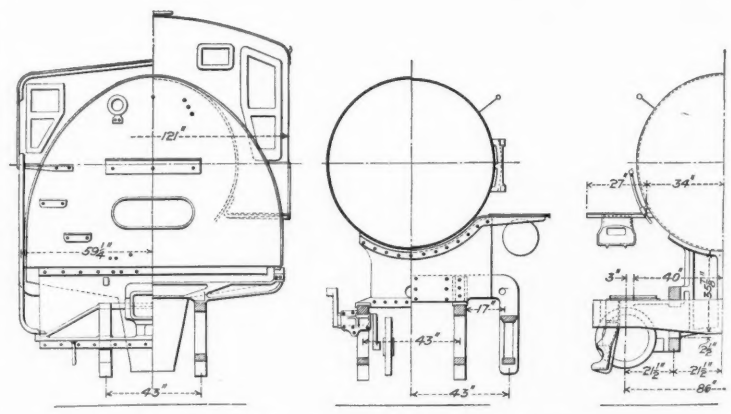
It being sometimes charged that many or most accidents are due to the overworking of the railroad employees, the Prussian State Railroads have for some time kept records of the number of hours men charged with negligence had been on duty at the time of the accident. The result is announced as follows: In 12.6 per cent. of the cases the man had been on duty for an hour or less; in 10.8 per cent., from 1 to 2 hours; in 10 per cent., from 2 to 3 hours; in 10 per cent., from 3 to 4 hours; in 10 per cent., from 4 to 5 hours; in 7.2 per cent., from 5 to 6 hours; in 7.9 per cent., from 6 to 7 hours; in 6.6 per cent., from 7 to 8 hours; in 7.6 per cent., from 8 to 9 hours; in 7.3 per cent., from 9 to 10 hours; in 5 per cent., from 10 to 11 hours; in 3.6 per cent., from 11 to 12 hours; in 1.4 per cent., from 12 to 13 hours. This is a very striking statement, though it must be borne in mind that large classes of employees are on duty only in exceptional cases more than 10 hours, and those who serve longer than 12 are usually in positions where they have long intervals of leisure, as at rarely opened crossing gates, etc. But most of the men work as much as ten hours a day, and yet it appears that the proportion of accidents in the first 5 hours of work to that in the second 5 is as 53.4 to 36.6, and decidedly the greatest number of mistakes are made in the first hour of the tour of duty.

Consolidation (2-8-0) Locomotive for the Delaware & Hudson.

The accompanying illustrations show one of a lot of 24 consolidation (2-8-0) locomotives recently built at the Cooke Works of the American Locomotive Company for the Delaware & Hudson. The engine has a wide fire-box designed for burning fine anthracite coal. The cylinders are simple, 21 in. x 30 in. The working pressure is 190 lbs. per sq. in. Assuming that 85 per cent. of the boiler pressure is available as mean effective pressure at starting gives 37,500 lbs. as the maximum tractive effort. The engine weighs 193,000 lbs. in working order, with 170,000 lbs., or 88 per cent. of the total weight, on the drivers. The drivers are 57 in. in diameter. The total heating surface is 3,407.8 sq. ft., of which 307.6 sq. ft. is in the fire-box. The grate area is 90.06 sq. ft. The boiler contains 411 2-in. tubes 14.6 in. long between tube sheets. Some of the typical ratios follow:







Weight on drivers to maximum tractive effort	4.54
Weight on drivers to total heating surface	49.9
Total heating surface to grate area	37.8
Total heating surface to fire-box heating surface	11.1
Steaming capacity*	.197

*For steaming capacity formula, see *Railroad Gazette*, June 19, 1903.

A general description follows:

Kind of fuel to be used	Fine anthracite
Weight on drivers	170,000 lbs.
Weight on truck wheels	23,000 lbs.
Weight, total	193,000 lbs.
Weight, tender, loaded	135,100 lbs.

General Dimensions.

Wheel-base, total, of engine	25 ft. 5 in.
Wheel-base, driving	17 ft. 0 in.
Wheel-base, total (engine and tender)	53 ft. 6 in.
Height of stack	14 ft. 11¾ in.
Heating surface, fire-box	225.4 sq. ft.
Heating surface, water tubes	82.2 sq. ft.
Heating surface, tubes	3,100.2 sq. ft.
Heating surface, total	3,407.8 sq. ft.
Grate area	90.06 sq. ft.

Wheels and Journals.

Drivers, number	8
Drivers, diameter	57 in.
Drivers, material of centers	Cast steel
Truck wheels, diameter	30 in.
Journals, driving axle, size	9 in. x 11 in.
Journals, truck axle, size	6 in. x 10 in.
Main crank pin, size	7 in. x 5¼ in.

Cylinders.

Cylinders, diameter	21 in.
Piston, stroke	30 in.
Piston rod, diameter	3½ in.
Steam ports, length	18 in.
Steam ports, width	1¼ in.
Exhaust ports, length	18 in.
Exhaust ports, width	2¾ in.
Bridges, width	1⅛ in.

Consolidation (2-8-0) Locomotive—Delaware & Hudson.

Valves.

Kind of	Richardson balanced
Greatest travel	5½ in.
Outside lap	⅞ in.
Inside lap or clearance	0 in.
Lead in full gear	0 in.

Boiler.

Type of	Straight top
Working steam pressure	190 lbs.
Thickness of material in barrel	11/16 in.
Diameter of barrel	74⅝ in.
Seams, kind of horizontal	Butt joint, sextuple riveted
Seams, kind, circumferential	Double
Thickness of tube sheets	9/16 in.
Thickness of crown sheet	⅜ in.
Crown sheet stayed with	Radial stays

Fire-box.

Length	120¼ in.
Width	108 in.
Depth, front	71 in.
Depth, back	61½ in.
Material	"Worth" steel
Thickness of sheets	Sides, ⅜ in.; back, ⅜ in.

Water space, width:
Front 3½ in.; sides, 3 in.; back, 3½ and 4½ in.
Grate, kind of.....Rocking, with water tubes

Tubes.

Number 411
Material.....No. 11, B. W. G. National charcoal iron
Outside diameter .....2 in.
Length over sheets .....14 ft. 6 in.

Other Parts.

Exhaust nozzle, single or double.....Double
Diameter.....3⅜ in., 3½ in., 3⅝ in.
Stack, straight or taper .....Taper
Stack, least diameter .....16 in.
Stack, greatest diameter .....17¾ in.

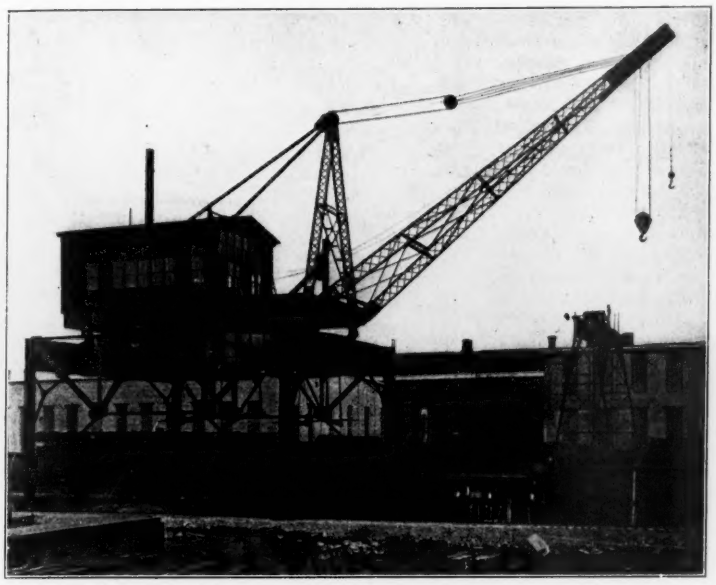
Tender.

Type 8-wheel
Tank capacity for water .....7,500 gals.
Coal capacity .....11 tons

Type of truck.....Arch bar, I-beam bolster
Diameter of truck wheels.....33 in.
Diameter and length of axle journals.....5½ in. x 10 in.

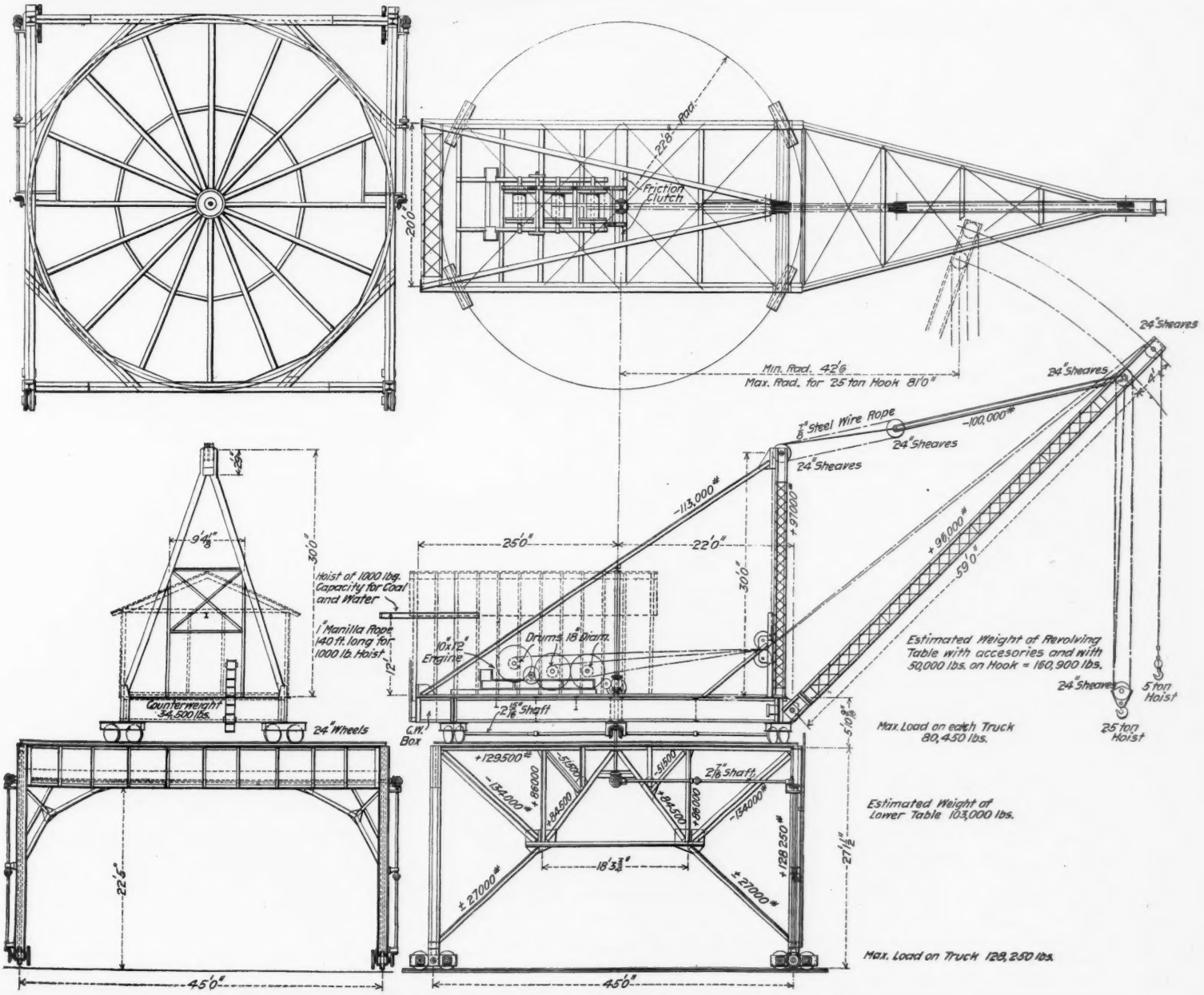
A 25-Ton Traveling Yard-Derrick.

The traveling derrick shown herewith has been designed and built by the Dominion Bridge Company, Ltd., and is used in their yards at Lachine, Quebec. The derrick has two hoisting hooks of 25 tons and 5 tons capacity respectively. The maximum radius for the 25-ton hook is 81 ft. The 10 in. x 12 in. hoisting engine in the operator's house drives the three winding drums and by a system of gears also rotates the table on the traveler or moves it along its track. The left winding drum operates the boom, the middle drum operates the 25-ton hook and the right drum operates the 5-ton hook.



The counterweight box contains 34,500 lbs. of punchings.

The revolving table has four two-wheel trucks running on a circular track 45 ft. 4 in. in diameter. The estimated weight of the revolving table and accessories with 25 tons on the hook is 160,900 lbs. The maximum load which comes on any truck is 80,450 lbs. The truck wheels are 24 in. in diameter. The estimated weight of the traveler or lower table is 103,000 lbs. and the maximum load on any truck is 128,250 lbs. The traveler has four two-wheel trucks with wheels 24 in. in diameter. The total height from the top of the rail to the top of the vertical compression member of the derrick is 63 ft. An auxiliary hoist of 1,000 lbs. capacity at the rear of the operator's house is used for hoisting coal and water to the boiler.



25-Ton Traveling Derrick—Dominion Bridge Company, Montreal.

Compound Locomotives in France.

At the March meeting of the Institution of Mechanical Engineers M. Edouard Sauvage presented a paper on the above subject. In the preliminary remarks he pointed out that for a complete appreciation of a certain class of locomotives it is necessary to know, first, the kind of service for which the locomotive is best fitted, and, second, the weight of train the locomotive is able to haul at a given speed over a given line. The expense by which the service is obtained must also be considered. The importance of scientific data concerning locomotive performance was pointed out and the best plan for collecting such data was thought to be by means of a locomotive laboratory such as that in use at Purdue University.

All the available data of the performance of compound locomotives in France have been obtained by means of experimental runs and prolonged service. The most interesting feature of French locomotive practice is the development of the four-cylinder compound, which made possible a marked increase in the weight and speed of trains. The principal French roads continue to build locomotives of this type. The number of compound locomotives in use, or ordered, by the French roads has increased from 803 in 1900 to 1,577 in 1903. Most of these engines belong to two classes—the express locomotives with four drivers about 78 in. in diameter and the 6-coupled locomotives with drivers about 62 to 68 in. in diameter, both types having a 4-wheeled truck in front. In some cases, especially for working freight trains on heavy grades, 8-coupled locomotives are used, either with or without forward or rear trucks. The Southern has rebuilt some engines as 2-cylinder compounds with 6-coupled wheels and a pony truck in front. This company is now rebuilding old express locomotives in this manner.

The Northern of France has added 33 Atlantic type 4-cylinder locomotives to its equipment, slight alterations having been made to the previous type used on this road. The distance of the truck wheels from each other has been increased from 5 ft. 10⅞ in. to 6 ft. 6¾ in. in order to obtain greater stability, and the length of the tubes in the boiler has been increased from 13 ft. 9⅜ in. to 14 ft. $^{15}/_{16}$ in. A new Atlantic type locomotive recently built for the Paris-Orleans is the most powerful express locomotive yet built for the French roads. This engine carries a working pressure of 228 lbs. The heating surface in the boiler is 2,577 sq. ft. and the grate area is 33⅜ sq. ft.

The cylinders are 14 3/16 in. and 23⅝ in. x 25½ in., and the total weight in working order is 71¾ tons.

A great many compound locomotives having six drivers have recently been ordered in France, the total number in use on October 1, 1903, being 817. The Western of France has ordered 20 6-coupled compound locomotives. The principal dimensions of these machines are: working pressure, 213.3 lbs. per sq. in.; heating surface, 2,174 sq. ft.; grate area, 26⅜ sq. ft., and cylinders, 13¾ in. and 21⅝ in. x 25½ in. The driving wheels are 75 3/16 in. in diameter, while the weight in working order is 62½ tons. Tests of these locomotives between Paris and Le Mans have been made. The following tables give the comparative results obtained from these compound locomotives and from simple locomotives:

Compound Locomotives.

Month.	Mileage.	Av'ge wgt. of train, tons.	Coal consumed. Lbs. per mile.	Lbs. per mile per 100 tons.	Oil lbs. per mile.	No. of minutes saved.
1899—						
May	16,468	438	56.8	13	0.177	3,763
June	17,870	435	53	12.1	0.179	3,886
July	23,516	402½	40	9.9	0.185	5,050
August	25,291	403½	49.3	12.2	0.182	5,547
September	23,528	425	52.1	12.2	0.188	5,839
October	27,928	383¾	53.2	13.8	0.177	9,213
November	29,157	380¾	57.8	15.3	0.178	9,539
December	31,472	400½	63.1	15.8	0.189	11,467
1900—						
January	24,614	442	63.1	14.3	0.167	5,399
February	23,009	447¾	62.4	14	0.164	4,877
March	26,513	466½	60	12.8	0.171	5,592
April	24,442	464½	58.2	12.5	0.171	5,236
Totals & av'gs.	293,808	424	55.7	13.3	0.179	75,408

Simple Locomotives.

1899—						
May	23,940	279½	54	19.3	0.094	4,110
June	24,470	282½	51.8	20.8	0.103	4,813
July	23,990	282½	49	17.3	0.099	4,205
August	23,700	276½	50.4	18.2	0.108	4,219
September	20,962	275½	50	17.8	0.108	4,455
October	25,596	283½	55.3	19.5	0.108	6,687
November	23,285	277½	61.4	22	0.104	5,384
December	26,701	272½	70.3	25.8	0.089	6,272
1900—						
January	25,511	278½	65	23.3	0.090	4,648
February	24,875	286½	65	22.6	0.089	3,922
March	28,573	279½	57.1	20.3	0.085	4,606
April	22,130	267¾	56	20.9	0.092	4,614
Totals & av'gs.	293,733	278½	57.1	20.5	0.097	57,935

A tandem compound locomotive has recently been built by the Northern of France for handling passenger trains on the Ceinture Railroad of Paris, which is a circular road around Paris, 19½ miles long and having 23 stations. The gradients are about 1 per cent. In order to avoid loss of time simple locomotives must run in full gear until the regular speed is attained. This practice results in a large steam consumption and the powerful blast disturbs the fire on the grate. The use of a compound locomotive under these conditions is contrary to the prevailing opinion that this type of engine is not well fitted for frequently stopping trains; but it seems that compounds with cylinders correctly proportioned give less trouble and consume less steam than simple engines when worked in full gear for a long time. This new locomotive weighs 50 tons empty and 62.19 tons in working order. The steam pressure is 228 lbs. per sq. in. The boiler contains 1,484 sq. ft. of heating surface and the area of the grate is 24 7/16 sq. ft. The cylinders are 13 in. and 21¼ in. x 23⅝ in. The locomotives are giving satisfactory service, the whole circuit being made in 1 hr. 5 min. The present schedule allows 1 hr. 20 min.

The Walschearts valve gear has been adopted for many of the French 4-cylinder compounds as well as for simple locomotives. This system is desirable when the valve is placed above or under the cylinder. There is also a decided advantage in the use of one eccentric instead of two for inside as well as for outside cylinders. The mechanism is simple and easily kept in order. In order to avoid excessive compression of compound locomotives, auxiliary contrivances are necessary and much larger clearance than usual must also be provided. On the Eastern of France the locomotives have a clearance of about 18 per cent. for the high-pressure cylinders and 12 per cent. for the low-pressure cylinders. On the Southern the clearance is from 12 to 14 per cent. for the high-pressure cylinders and from 7 to 9 per cent. for the low-pressure cylinders. The valves generally have a negative lap of about .06 inches. On the Eastern locomotives this negative lap is given to the low-pressure valves only. With these precautions experience has proved that the highest speeds may be obtained with compounds as well as with simple engines. Experiments made on the Northern of France show that it is desirable to have the steam pipes supplying the high-pressure cylinders of large diameter. With 13⅜-in. or 13¾-in. cylinders it is advisable to have a steam pipe 3½ in. in diameter.

All recent 4-cylinder compound locomotives are provided with a direct exhaust for the high-pressure cylinders, with an admission of steam from the boiler (at a reduced pressure) to the low-pressure cylinders. This device avoids difficulty in starting. For heavy freight trains running at low speeds separate working of the four cylinders may be necessary, but generally adhesion would be found sufficient.

But little has been done in France with superheated steam for locomotives.

Piston valves have been found advantageous on the Eastern on account of providing larger steam passages than flat valves, and thus reducing wire drawing both for admission and for exhaust. The valves have inside admission. Compared with similar locomotives having flat valves and handling the same traffic during a prolonged period the piston valve engines have shown an economy of 10 per cent. in the coal consumption. The blast pipe is generally of the French design having two movable flaps. In some cases a transverse edge has been added with advantage. There is a tendency in France to revert to the old system of placing sand boxes on the top of the boiler for keeping the sand dry.

At the conclusion of his paper Mr. Sauvage gave the opinions of some prominent French locomotive superintendents regarding the use of 4-cylinder compound locomotives.

Mr. Du Bousquet, the Locomotive Superintendent of the Northern, said that compound locomotives have been used on his road since 1884. At that time a 4-cylinder locomotive was ordered which was practically identical to the engines then in service, the only essential difference being that in the compound the steam passed first through high pressure cylinders 13 in. in diameter. During a period of nearly 18 years (from 1884 to 1902) the coal consumption of this compound, compared with simple locomotives, has been constantly less, the average consumption being 30.5 lbs. per mile against 36.92 lbs. per mile for the simple locomotives. The oil consumption was increased to 8½ lbs. per 100 miles from 6.7 lbs. for the simple locomotives, but the additional expense on this account was slight. The cost of repairs for both types of locomotives was about the same. He thought that the principal advantage of the compound locomotive on his line was not due to the decreased coal consumption inasmuch as coal is cheap, but because for a given weight of engine a greater useful effect is obtained with the compound locomotive than with the simple locomotive, consequently, the speed on rising grades is increased, or the weight hauled is larger, or speed and weight are both increased. Also, the daily mileage of locomotives, enginemen, train staff, etc., is greater, and the equipment is better utilized.

Mr. Moffre, Locomotive Superintendent of the Southern, thought that although expenses for repairs and for lubrication of 4-cylinder compound locomotives are a little larger than for simple engines, they nevertheless haul much heavier trains with slightly smaller coal consumption.

Mr. Salomon, the Locomotive Superintendent of the Eastern, says that from 10 to 15 per cent. of coal is saved by the use of compound locomotives. Owing to the greater uniformity of the stresses set up by the 4-cylinder compound the mileage between two general repairs has been increased by 50 per cent.

In conclusion, Mr. Sauvage says: From a prolonged practice with more than a thousand engines it may be taken for granted that the 4-cylinder compound possesses marked advantages, at least under the conditions of service prevailing on main French lines. By their use, French railroads have been enabled to increase the weight and the speed of trains, without any large increase in coal consumption. By their use the weight of trains is increased by one-third with the same expense for fuel over what it was with the best simple engines; or, if not the weight, speed is increased, and in many cases both weight and speed.

In other words, the compounds would take a traffic equal to four, against a traffic equal to three, the number of engines and the expenses for fuel and wages remaining the same. Of course, the initial cost of the compounds is higher, the expenses for repairs may be somewhat greater, but the increase of traffic is such that the economy is obvious. As regards the expenses for repairs there is still some doubt as to their exact value, as a very large proportion of the compounds have been running for a few years only, but the increase of expenses will very likely be due to the boilers working at a high pressure, and it seems that the same pressures would be necessary for simple engines, if they were to compete with compounds.

To this must be added, specially for passenger service, the advantages of greater speed, of more punctuality, and of dispensing in many cases with pilot engines or of supplementary trains.

It is clear that simple 2-cylinder engines might be made with the same large boiler, and work with the same high pressure, but it is nearly as clear that with the ordinary valve gear of the locomotive, steam at such a high pressure cannot be as well utilized as by compounding. There is little doubt that the simple locomotive would require more steam for the same work or give less work for the same quantity of steam. In addition, there is real difficulty in making all the parts of the simple engine strong enough to stand without undue wear the great stresses resulting from the increased pressure on large pistons, although this difficulty may be overcome.

According to some German engineers, superheating steam would be equal to compounding. Of course, theory proves that the effect of superheating may be very good, and the results of experiments appear satisfactory, but superheating does not seem to exclude compounding. Until the question is solved, practical men in France will probably stick to the system of 4-cylinder compounds, of which the merits are firmly established. This, of course, does not exclude experiments of other systems, and no one to-day can boast that he made an engine which will remain without a rival for a long period.

Of course, compound locomotives, as any other engines, must be used under proper conditions of service to be economical. Powerful locomotives must have sufficiently heavy weights to haul, or else they become wasteful. It would be a mistake to use them on branch lines with light trains. But in practice a railroad company is never without old locomotives which are quite fit for this restricted traffic.

An opinion which seems to prevail is that compound locomotives may be economical during long runs, but that their advantage is lost when they stop and start frequently, owing to the direct admission of steam to the low-pressure cylinders at starting. This opinion is rather too definite, and the question requires some consideration. In many cases, with 4-cylinder compounds the tractive power necessary for starting from rest is obtained without this direct admission, or steam is admitted in that way only for the very first turn of wheels. The engine is then worked compound, but in full gear for all cylinders. Of course, steam is not so well utilized than with a proper degree of expansion in each cylinder, but even in that case the compound compares favorably with a simple locomotive working in full gear.

Let us suppose a compound with two cylinders of 13⅜-in. and two cylinders of 20⅞-in. diameter, the stroke being 25⅛ in., and the effective pressure in the boiler 213 lbs. per sq. in., and a simple engine with cylinders of 19 in. x 25⅛ in., working under an effective pressure of 170.6 lbs. per sq. in. This represents fairly what might be considered as equivalent in practice. The diameter of wheels is the same in both cases. With a full admission of steam, i. e., rectangular diagrams, the work of steam on the pistons during a revolution, reduced to 85 per cent., on account of drop of pressure and rounded corners of diagrams, would be 321,868 ft. lbs. With the compound, working full gear, the effective pressure would be 78.2 lbs. per sq. in. in the receiver, and the work exerted on the pistons, during one revolution, would be, after a reduction to 80 per cent. (the drop of pressure being somewhat larger in the compound), 303,786 ft. lbs., or nearly the same value.

The capacity of the high-pressure cylinder of the compound being one-half of the capacity of the cylinder of the simple engine, the volume of steam consumed is one-half in the compound, but at a greater density. The weights are as 0.6 in the compound to 1 in the simple engine. Of course, this proportion is altered by the condensations on the cylinder walls, but this would be rather in favor of the compound. This approximate calculation, not far from the conditions of practice, shows that without direct admission of steam to the low-pressure cylinders, the compound may be nearly equal to the simple locomotive as regards maximum tractive power, but with an important economy in steam when full gear working is considered

The Westinghouse Single Phase Motor.

The limitation of the alternating current system has been wholly due to the lack of a successful alternating-current motor, capable of operating on a single-phase circuit. The series wound direct-current motor has practically superseded all others in traction service, and has become generally regarded as the only type applicable, possessing, as it does, the essential characteristics of a

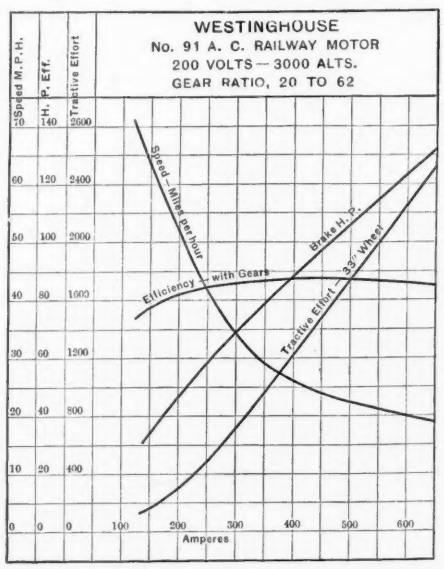


Fig. 3.—Performance Curves of No. 91 Westinghouse Motor.

torque which increases as the speed decreases, and a speed variation over a wide range which is under sufficient control. The method by which this speed control is obtained is, however, both troublesome and inefficient. The standard direct-current railroad equipment, with series parallel control, possesses but two economical running speeds, viz., with motors in series and motors in parallel, with no resistance in circuit. Any other speed of car is secured only at a costly sacrifice of efficiency,

involving a wasteful absorption of energy in the controlling resistance. No present standard equipment will permit running on a "resistance point" a serviceable length of time, it being impractical to equip a car with resistance of sufficient capacity for continuous operation. It is claimed that the single phase motor described herewith, which has been developed by the Westinghouse Electric & Manufacturing Company, possesses the speed and torque characteristics of the direct-current series motor.

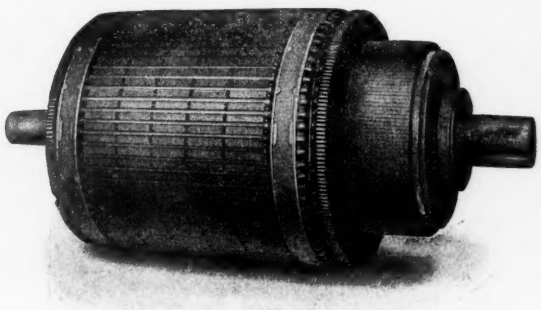


Fig. 2.—Armature, Commutator and Shaft of Single Phase Motor.

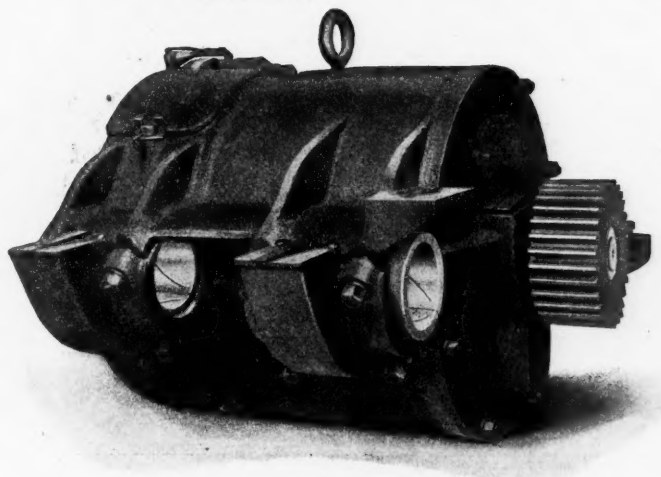


Fig. 1.—Westinghouse Single Phase Railroad Motor (No. 91).

It may also be operated on a single circuit, free from voltage limitations.

In general appearance the alternating current series motor does not differ greatly from the standard d. c. motor. The laminated core is built up of circular punchings of soft steel, securely bolted together and rigidly held within a cylindrical frame of cast steel. Lugs are provided on the casting for "nose" suspension, and for the support of the gear case. A large opening over the commutator and hand holes in end brackets and bottom of frame give easy access to the commutator and brushes, and permit inspection of the field and armature.

Supports for the armature bearings are cast solid with the end brackets. The bearing construction follows standard railroad practice. A solid cast shell, with babbitt lining, is used for the armature shaft. The axle boxes are divided and babbitt lined. All are designed for oil lubrication. Bearing boxes are packed with waste. The upper caps of the axle bearings are cast solid with the frame. The lower caps are securely held by bolts. The gear case is of standard design. The laminated field core contains inwardly projecting poles of rectangular section. The field coils are held in place by simple and easily adjusted hangers. These coils are wound with copper strap, bent on edge and insulated, after being formed, with specially prepared material. The field coils are connected permanently in series. A drum type core with open slots is wound with machine-formed coils of copper strap connected in multiple. The coils are held in place by retaining wedges of hard fiber which fit in grooves punched in the armature teeth. There are no band wires over the core. Numerous ventilating spaces in the core permit free circulation of air and insure cool operation. The commutator is built up of cold-rolled copper segments. The brush holders are of the sliding-shunt type with carbon brushes.

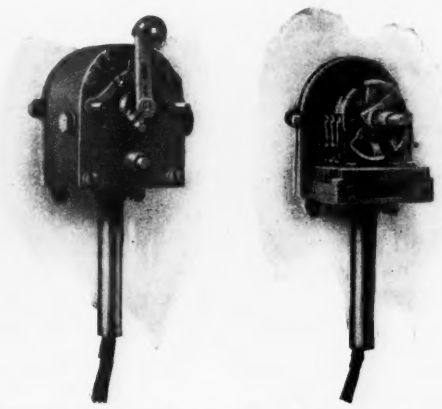


Fig. 5.—Master Controller for Single Phase Motor Equipment.

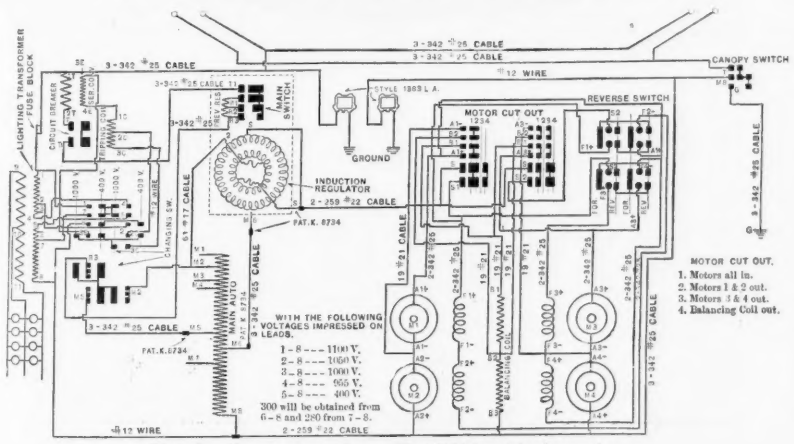


Fig. 6.—Connections for a Four-Motor Equipment.

Fig. 8.—A Pair of No. 91 Single Phase Motors Mounted on a Standard Truck.

The No. 91 motor is wound for a potential of 225 volts and a frequency of 25 cycles or less. At normal voltage and full load the armature speed is about 700 r.p.m. Performance characteristics which are given by Fig. 3 show the similarity in the operation of this motor and d. c. motors.

An auto-transformer is provided to reduce the trolley potential to that desired at the motors. It is the shell type, with single coil, and of standard construction. A two-coil transformer may be used in place of the auto-transformer, often with advantage; it is desirable with motors connected in multiple and a lower secondary voltage. The lighting transformer is the standard type and current for the car heaters may be taken from the secondary of this transformer.

Speed control is obtained by the induction regulator without the interposition of a serious resistance. The losses in a regulator of this type are very low. A high operating efficiency at any speed is therefore secured. This holds true at starting. The regulator consists of two coils, shown diagrammatically in Fig. 4, wound on separate cores, and so mounted that their relative angular position may be varied at will. The primary coil "b" is connected between the trolley and the motors. One end of the secondary coil is connected to the auto-transformer "a"; the other joins the primary at the motors. The voltage developed in the secondary coil varies with change of angular position, and may be either added to or subtracted from that of the auto-transformer. This method provides a voltage range double that of the regulator, and consequently permits the use of a smaller size than would otherwise be possible. The regulator is operated by an air motor, connected to the shaft by a worm gear and controlled by magnet valves.

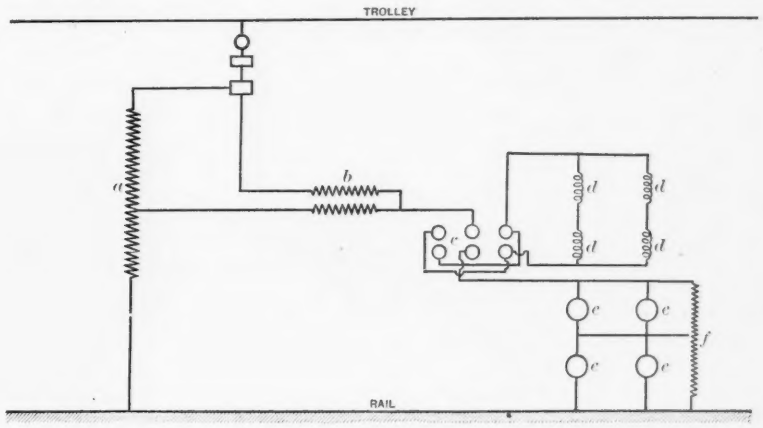


Fig. 4.—Auto-Transformer (a), Induction Regulator (b), Reversing Switch (c), Field of Motors (d), Armature of Motors (e), Equalizing Transformer (f).

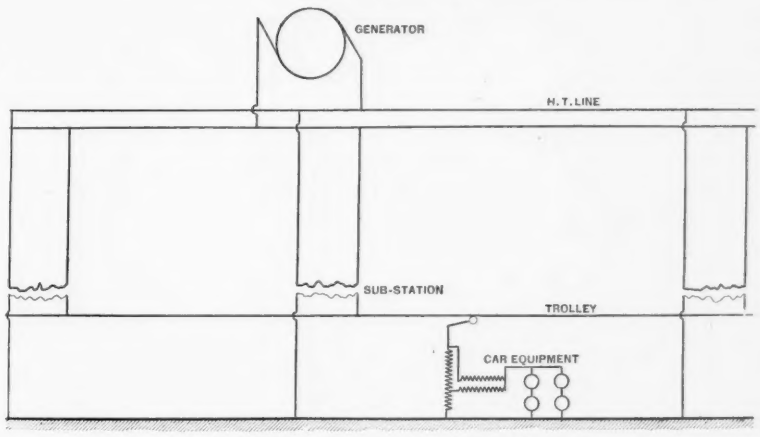


Fig. 7.—General Arrangement of Apparatus.

The main and reversing switches are the drum type, operated by pneumatic cylinders, and controlled by magnetic valves. The cut-out switch is the hand operated drum type. The circuit-breaker is oil-immersed, automatically and pneumatically operated. A master controller is placed at each end of the car. A single motorman can control one or more cars. Each controller consists essentially of a skeleton brass drum, mounted upon an insulated shaft and stationary contact fingers which make contact with points upon the drum. The drum is made in one casting, with contact points so spaced as to give the proper combinations. These controllers are connected only with the low voltage circuits from the storage battery, which operates the magnetic valves. A motor-driven air compressor supplies air for the brakes and pneumatic valves.

The induction regulator, main and reversing switches and car circuit-breaker are all operated by magnet valves, controlled from either of the master controllers. These magnet valves are actuated by a low voltage current from a small storage battery. For the multiple control of a train it is, therefore, only necessary to carry this low voltage battery circuit from car to car. Seven-point plugs and sockets provide an easy method for making these connections.

A diagram of connections of a four-motor equipment is

given in Fig. 6. The four motors are arranged in pairs, each consisting of two armatures in series and two fields in series. The two pairs are connected in parallel. This equipment is designed to operate with a trolley potential of 1,000 to 1,200 volts, reduced by the auto-transformers on the car to about 300 volts.

The single phase motor is also applicable to cranes, elevators, hoists, conveyors, etc. With this system trouble due to electrolysis is avoided. The presence of the auto-transformer on the car is also a safeguard against damage by lightning, etc. Motors of this type may be operated on a direct current line such as is now standard. This involves no change in the motors or line construction, but necessitates a modification of the controlling apparatus. It is therefore practicable to install the a. c. system for suburban or long distance service and yet run the cars within a city having the d. c. system. With a complete a. c. installation it is possible to operate at a low trolley potential within the limits of the city and yet secure the advantages of a higher voltage on the longer lines without. For this purpose a simple device changing the auto-transformer connection is all that is required.

Cross-Bending Tests on Steel-Concrete Beams.

These tests were made for the St. Louis Expanded Metal Fire Proofing Co. by Prof. Malverd A. Howe at Rose Polytechnic Institute, Terre Haute, Ind. The beams were concrete, re-enforced with corrugated steel bars. Prof. Howe describes the tests in a paper presented to the Western Society of Engineers, Chicago, Wednesday, April 6.

The object of the tests was to obtain the actual strength in cross-bending of full-size concrete beams reinforced with corrugated bars, according to the formula of Mr. A. L. Johnson. It was afterwards decided that, in conjunction with the determination of the cross-bending strength, there should also be recorded the deflections and the movement of the neutral axis. In order that the concrete and steel should represent products likely to obtain in practice, Atlas cement, bank sand, crushed rock and corrugated steel bars were purchased in the open market. The mixing was done by a local contractor of experience, with his own gang of men and in the manner he ordinarily employed.

The quality of the materials was, in general, good. The cement was satisfactory in every way. The sand, while containing some "dirt" in the form of yellow clay, was a fair representation of bank sand used in Terre Haute. The crushed limestone was in two parts, one coarse and the other fine, the two mixed forming the run of the crusher. The coarse stone would pass a screen of 1½-in. mesh and would stop at one of ½-in. mesh. The fine stone would all pass a screen of ½-in. mesh. The corru-

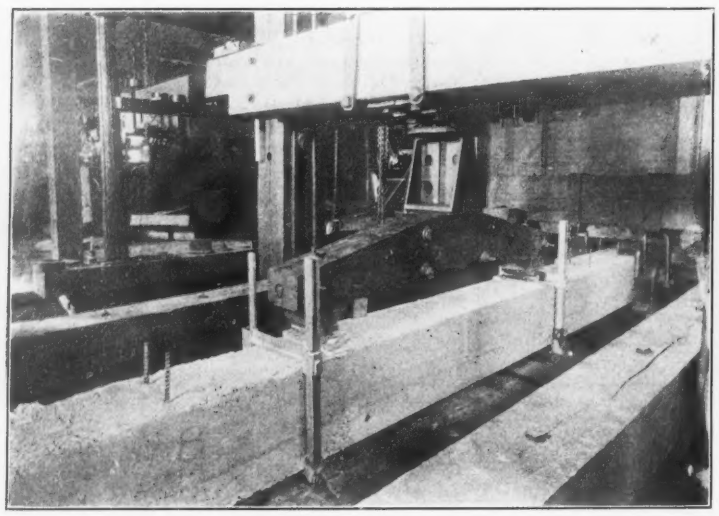


Fig. 1.—Beam No. 8.
(Depth of beam, 14 in.; span, 15 ft.)

Fig. 8.—Beam No. 1.
(Depth of beam, 5 in.; span, 10 ft.)

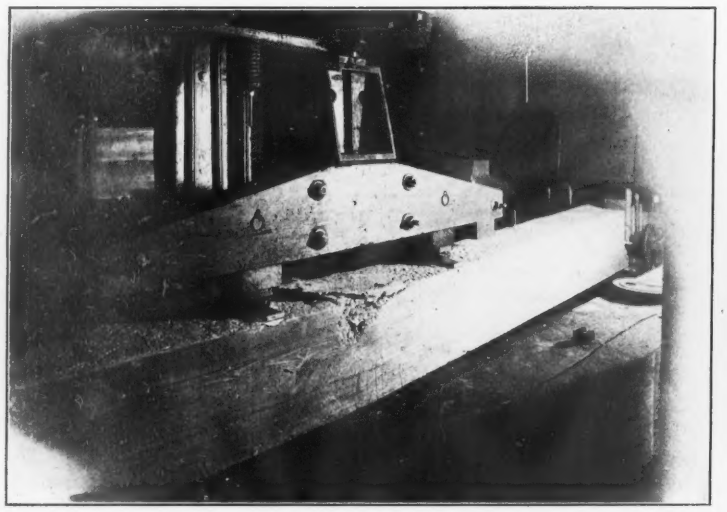


Fig. 9.—Beam No. 6e, Gravel.
(Depth of beam, 14½ in.; span, 15 ft.)

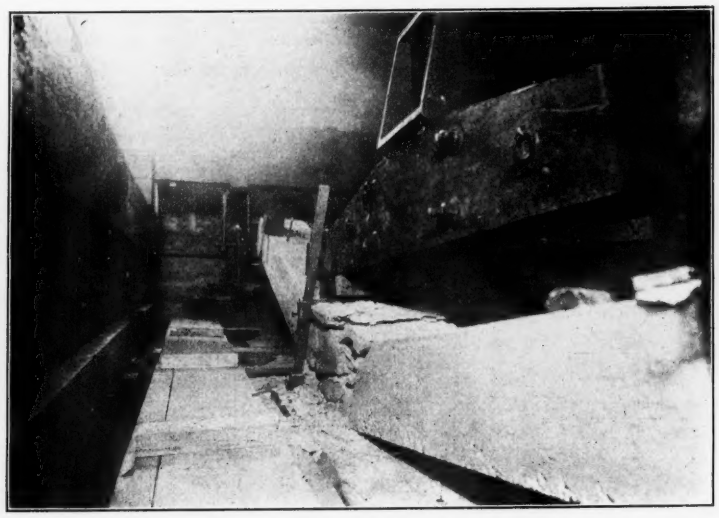


Fig. 10.—Beam No. 3.
(Depth of beam, 5 in.; span, 10 ft.)

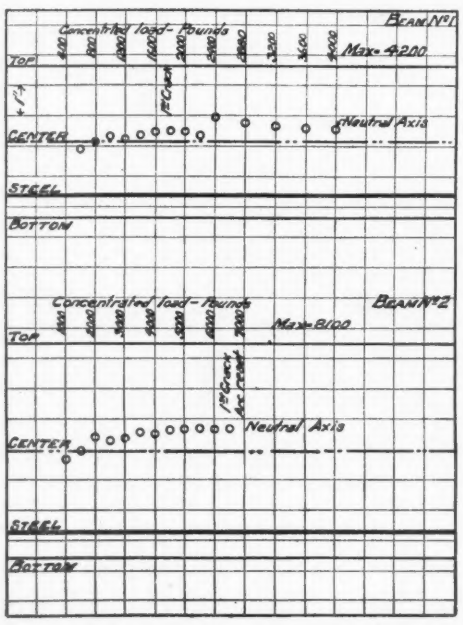


Fig. 2. **Fig. 3.** **Fig. 4.**

gated steel bars, when tested, showed an elastic limit of about 60,000 lbs., and an ultimate strength of about 100,000 lbs. The areas of the bars were, in general, as advertised, with the exception of the ¾-in. bars, which were found to be about 20 per cent. under size. The proportion of cement, sand and stone was practically 1 of cement to 7 parts of sand and stone.

The mixing was done on a concrete floor. The dry materials were placed in layers in the order of stone, sand and cement. The mass was first turned twice dry and then twice wet, the water being introduced from a hose. The mixture was then shoveled into barrows and wheeled to the molds and dumped over the sides. Four to 6-in. layers were deposited the full length of the molds and tamped with iron tamping bars. The first two batches were moderately dry and the others pretty wet, requiring but little tamping. Very rigid knock-down molds were used and no special means employed to obtain a smooth surface on the concrete, other than that given by mill-finished lumber. The molds were not wet before being filled and were not removed until the beam was to be tested. The beams were seasoned in basement rooms of a temperature of about 65 deg. F.

Table 1 shows the general dimensions of the beam and the arrangement of the steel bars. Although the bars were widely different in the dimensions of length and depth, yet all were designed on the same basis, the same percentage of steel being intended for each beam.

From each batch of concrete two prisms, 6 in. x 6 in. x 9 in. were made for compression tests. Unfortunately, however, no little care was taken in filling the molds that the specimens were very porous and non-homogeneous; consequently the results of the compression tests were of little value.

In testing a beam the ends were supported in stirrups, free to swing on knife edges at about the center line of the beam. Two equal concentrated loads were applied, symmetrically about the center of the beam, through knife edges in rolling seats, thereby producing a constant bending moment between the points of application of the loads (excepting the variable moment produced by the weight of the beam). The rolling seats for the knife edges were supported by ¾-in. x 4-in. steel plates, bedded in plaster of paris on top of the beam. This arrangement is shown in Fig. 1, for beam No. 8.

The vertical deflections were read directly from a scale on the side of the beam at the center by means of a silk thread fastened opposite the knife edges of the end stirrup. Measurements for the determination of the relative positions of neutral axis, under different loads, were made in the following manner: Four yokes were fastened to the beam by conical points in the positions shown on beam No. 8, Fig. 1. These were connected by wooden strips, as shown, and the relative positions of these determined at the top and bottom by means of a silk cord fastened to one and running over a graduated arc fastened to the other. The first readings of the arcs were taken under a small initial load. The data obtained can best be illustrated by giving the complete notes for beam No. 8 (see table V).

The general make-up of each beam is clearly shown by Fig. 5 and Table I. Table II gives the result of the tests in terms of the loads, bending moments and mode of failure. Table III was computed by Johnson's formula using the value of y_1 obtained from the experiments. This value was, in most cases, found graphically. For four beams, however, it was computed and the resulting values plotted.

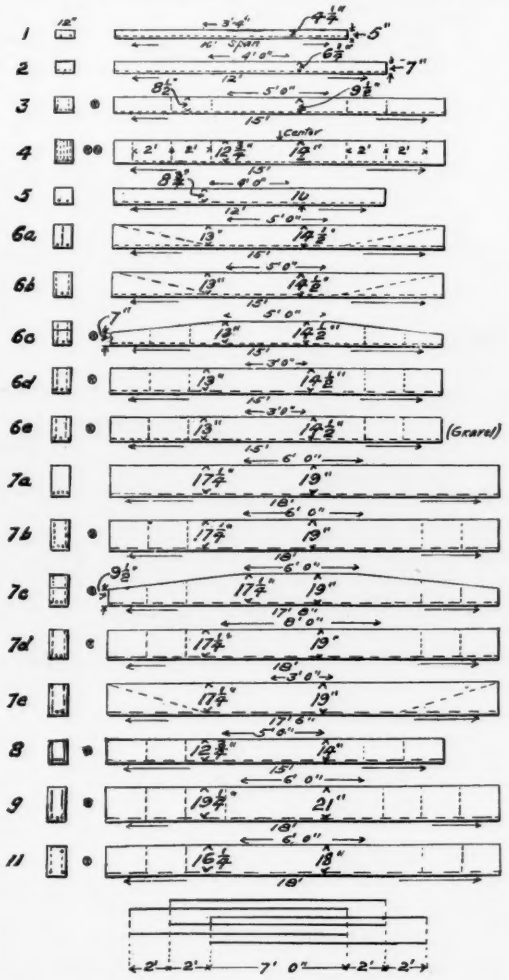


Fig. 5.—Form and Dimensions of Reinforced Concrete Beams.

These lines showed that at the commencement of the loading the neutral axis was below the center of the beam. As the load increased in magnitude the axis moved upward very rapidly until cracks commenced to appear on the bottom of the beam; then the axis remained approximately in the same position as long as the concrete did not show signs of failure in compression, as indicated by the drop of the scale beam. At or near the end of the experiment the axis, sometimes, not always, dropped suddenly. (See Figs. 2, 3 and 4.)

The values of y_1 are probably in error, but not enough to be of any practical importance. The travel of the neu-

TABLE V.—Beam No. 8. Tested Dec. 29, 1903.

Span, c. to c. of end stirrups.....15 ft. 0 in.
Span, c. to c. of concentrated loads..... 5 ft. 0 in.
Distance, c. to c. of extensometers..... 6 ft. 0 in.
Length, out to out, of beam.....17 ft. 11 in.
Weight of beam.....2,900 lbs.
Vert. dist. bet. conical points of extensometer yokes.12¾ in.
Vertical dist. bet. graduated arcs on extensometers..27⅛ in.
(Lower arc opposite lower conical point.)

Total con. load, lbs.	Ver. deflection at center, mm.	Upper arc.	Lower arc.	Remarks.
1,100	44.2	142.6	2.4	
2,100	44.8	141.4	2.6	
3,000	45.0	139.8	3.2	
4,000	55.6	137.4	4.2	
5,000	46.2	133.8	5.8	
6,000	47.8	128.2	8.4	
7,000	48.6	124.4	10.2	Crack 12 in. E. of W. load
8,000	49.8	120.0	13.0	Crack 6 in. E. of center, 8 in. W. of center, 14 in. W. of center, 4 in. E. of W. load, 18 in. E. of W. load
9,009	50.8	115.6	15.0	
10,000	52.0	111.4	17.2	Crack under W. load, shear crack 2 in. above bottom, extending 18 in. E. of W. load
11,000	53.2	108.8	19.2	Crack 6 in. W. of E. load
12,000	54.4	107.2	21.6	Crack 12 in. W.of W. load
13,000	55.6	90.4	23.6	Crack under E. load 15 deg. with vertical
14,000	56.8	93.4	25.6	
15,000	58.0	89.2	27.6	
16,000	59.2	84.6	30.0	Crack 6 in. W. of center
17,000	60.6	80.0	32.0	
18,000	61.8	75.4	34.0	
19,000	63.0	70.0	36.4	
20,000	64.4	65.0	37.4	Longitudinal crack 5 in. above bottom at both ends.
21,000	65.9	59.4	40.4	
22,000	67.5	53.4	43.2	
23,000	69.9	46.8	45.8	
23,200	95.0	...	...	
23,300	105.0 (Max. load.)		...	
22,765	135.0	...	...	
22,000	145.0 (Complete failure 30 in. W. of center.)			

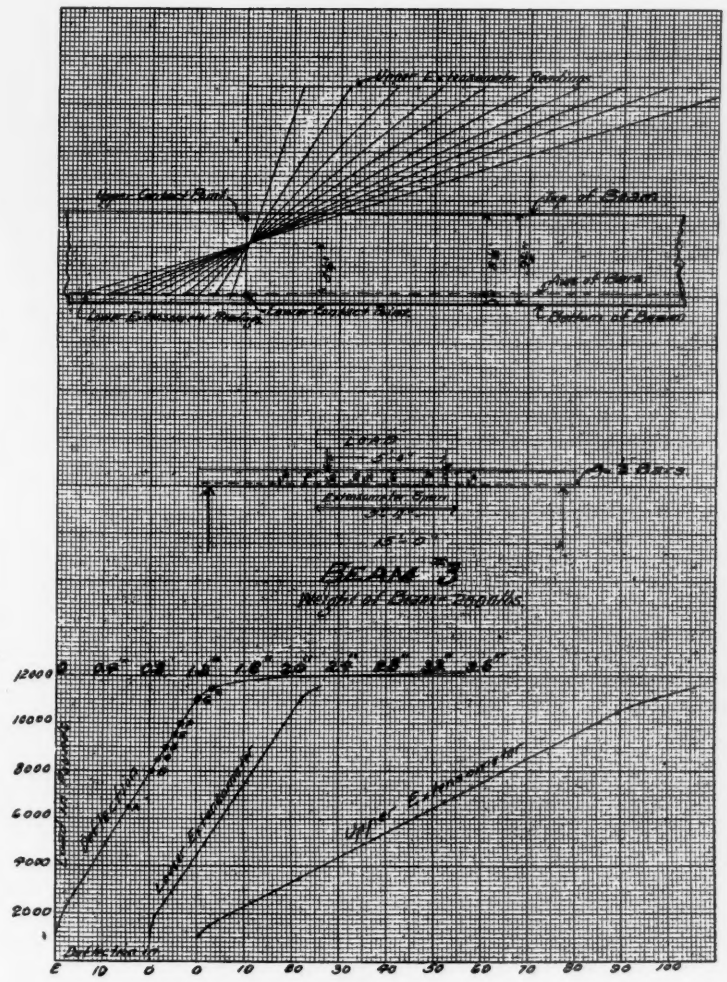


Fig. 6.

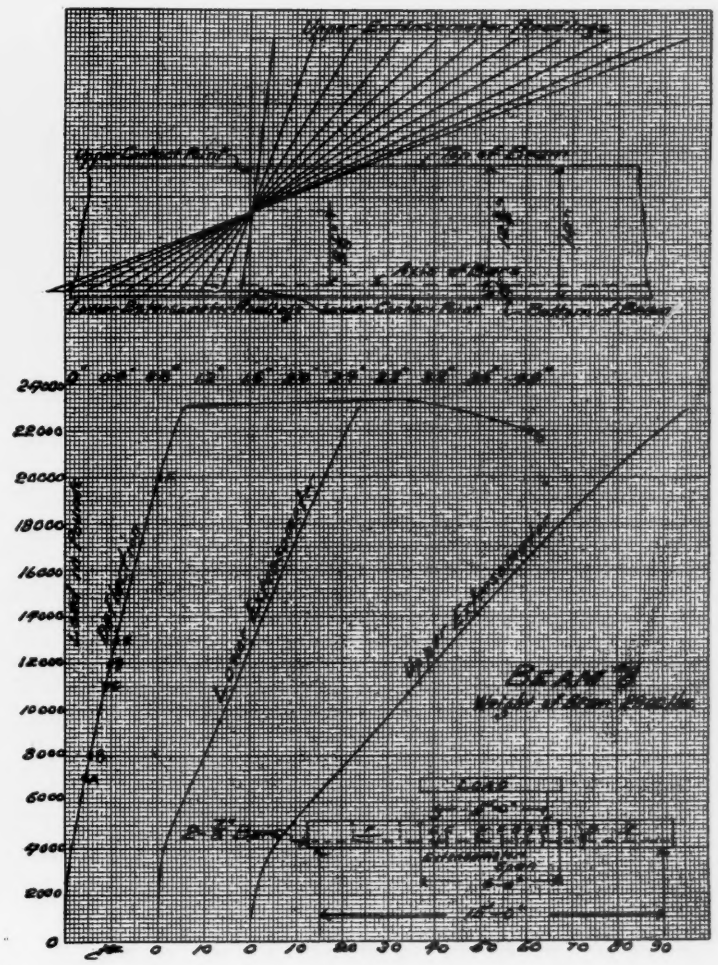


Fig. 7.

tral axis is correctly obtained by the methods employed (assuming that a plane section remains plane after its distortion of the fibers), but its exact location in reference to the center of the beam is not known, as the experiments were commenced under an initial load including the weight of the beam.

Table IV was computed, using the same values of y_1 as employed in Table III, under the assumption that the concrete resisted no tension, and that in compression the distortion of the concrete was proportional to the stress producing it.

Throughout the entire series of experiments the curves of deflection and extension showed a marked similarity. The appearances after tests of three of the 18 beams tested, and the plottings of the result obtained for three of the beams are very clearly shown in Figs. 6 to 10 inclusive, and illustrate the general characteristics of the beams. These diagrams were prepared by Mr. T. L. Condron, M. W. S. E., from the original records of the tests. By plotting the upper and lower extensometer readings in their correct relative position as regards the beam, and connecting the corresponding points with rays, the intersection of these inclined rays with the initial vertical line determines the location of the neutral axis at each stage of the test. It will be noted that these diagrams show in another way the same movement of the neutral axis as do Figs. 2 to 4 inclusive, already referred to. The distance of the neutral axis above the plane of reinforcing is given for the highest position of the neutral plane and not for the position at the time of maximum load. In these diagrams the deflections are given in decimals of an inch. The extensometer readings are plotted as observed. Ten divisions on the extensometers equaled 0.03932 in. or approximated 255 divisions to the inch.

The small circles and letters on the deflection curves indicate where fine hair cracks were first observed in the concrete on the tension sides of the beams and the relative position of these first cracks is shown on the small sketches on each diagram.

TABLE I.—Make-up and Dimensions of Beams.

Beam.	Made 1903.	Concrete batch.	Number and size of steel bars.	Nominal areas.	Actual net areas of steel.	Dist. ctr. steel below top of beam, *d*.	Total depth of beam.	Breadth of beam.	Length of beam over all.
			In.	Sq. in.	Sq. in.	In.	In.	In.	Ft. in.
1	Oct. 13.....	1	2—½	0.36	0.36	4¼	5	12	12 0
2	Oct. 13.....	1	3—½	0.54	0.54	6¼	7	12	14 0
3	Oct. 13.....	2-3	4—½	0.72	0.72	8½	9½	12	17 0
4	Oct. 14.....	9	6—½	1.08	1.08	12¾	14	12	17 0
5	Oct. 14.....	5	2—¾	0.74	0.60	8¾	10	12	14 0
6*a*	Oct. 14.....	6	3—¾	1.11	0.90	13	14½	12	17 0
6*b*	Oct. 14.....	6	3—¾	1.11	0.90	13	14½	12	17 0
6*c*	Oct. 14.....	8	3—¾	1.11	0.90	13	14½	12	17 0
6*d*	Oct. 14.....	6-7	3—¾	1.11	0.90	13	14½	12	17 0
6*e*	Oct. 15.....	12	3—¾	1.11	0.90	13	14½	12	17 0
7*a*	Oct. 13.....	3-4	4—¾	1.48	1.20	17¼	19	12	19 6
7*b*	Oct. 13.....	4	4—¾	1.48	1.20	17¼	19	12	19 6
7*c*	Oct. 14.....	9-10-11	4—¾	1.48	1.20	17¼	19	12	19 6
7*d*	Oct. 14.....	7	4—¾	1.48	1.20	17¼	19	12	19 6
7*e*	Oct. 14.....	9	4—¾	1.48	1.20	17¼	19	12	19 6
8	Oct. 13.....	2	2—⅞	1.10	1.06	12¾	14	12	17 0
9	Oct. 13.....	5	3—⅞	1.65	1.59	19½	21	12	19 6
11	Oct. 14.....	8	2—1	1.40	1.40	16¼	18	12	19 6

TABLE II.—Maximum Loads and Moments.

Beam.	Age in days.	Span c. to c. end supports.	Dist. between loading points.	Total wgt. of beam.	Total max. load.	Load when comp. failure was marked; load fall'g off fr'm max.	Max. moment 1000s of in lbs.	Theoretical moment, Johnson's formula.	See footnotes
		Ft. in.	Ft. in.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	
1	74	10 0	3 4	825	4,200	3,400	94.3	80.6	
2	76	12 0	4 0	1,150	8,100	5,100	212.2	174.2	
3	72	15 0	5 0	2,000	12,100	....	402.7	322.2	
4	73	15 0	0	2,860	19,400	....	929.8	725.0	[1]
5	71	12 0	4 0	1,700	11,900	....	311.9	283.0	
6*a*	71	15 0	5 0	2,935	18,300	....	607.2	625.0	
6*b*	69	15 0	5 0	2,950	19,325	16,500	638.3	625.0	
6*c*	115	15 0	5 0	2,450	20,400	19,100	666.3	625.0	
6*d*	29	15 0	3 0	2,960	15,500	....	616.8	625.0	[2]
6*e*	29	15 0	3 0	3,125	17,000	....	692.0	625.0	[3]
7*a*	78	18 0	6 0	4,450	30,000	28,500	1,189.4	1,121.0	
7*b*	78	18 0	6 0	4,325	29,000	23,600	1,152.0	1,121.0	
7*c*	70	17 9	6 0	3,800	30,100	....	1,142.9	1,121.0	
7*d*	68	18 0	8 0	4,450	29,900	....	1,006.4	1,121.0	[4]
7*e*	77	17 6	3 0	4,200	22,800	....	1,090.7	1,121.0	[5]
8	77	15 0	5 0	2,900	23,300	22,300	756.5	725.0	
9	77	18 0	6 0	4,850	34,800	....	1,373.7	1,652.6	[6]
11	75	18 0	6 0	4,225	29,000	25,700	1,149.3	1,177.8	

[1] 14,000 applied C ft. 6 in.; removed and loaded in center; failed at load. [2] Failed by compression near center. [3] Failure same as 6*d*; made of gravel from pit. [4] Several repetitions of load; failed by shearing. [5] Repeated loads; failed by shearing. [6] Failed by shearing.

TABLE III.—Fiber Stresses According to Johnson's Formula and Experimental y_1.

Beam.	Center of steel below top of beam, *d*, in.	Neutral axis below top of beam, y_1.	Max. stress concrete in comp., lbs. per sq. in.	Concrete in tension, lbs. per sq. in.	Steel in tension, lbs. per sq. in.	Batch in top of beam.	See footnotes.
1	4¼	0.45*d*	1,700	170	66,000	1	
2	6¼	0.45*d*	1,900	190	66,000	1	[1]
3	8½	0.38*d*	2,300	230	64,000	3	[2]
4	12¾	0.34*d*	2,500	250	64,800	9	[3]
5	8¾	0.42*d*	1,500	150	60,500	5	
6*a*	13	0.37*d*	1,500	150	51,000	6	
6*b*	13	0.37*d*	1,500	150	54,000	6	[4]
6*c*	13	0.42*d*	1,400	140	58,300	8	
6*d*	13	....	....	...	....	7	[5]
6*e*	13	....	....	...	....	12	[5]
7*a*	17¼	0.39*d*	1,600	160	57,000	4	[6]
7*b*	17¼	0.53*d*	1,600	160	53,500	4	[7]
7*c*	17¼	0.36*d*	1,600	160	53,500	11	
7*d*	17¼	0.35*d*	1,400	140	47,600	7	[8]
7*e*	17¼	0.35*d*	1,600	160	52,200	9	[8]
8	12¾	0.36*d*	2,000	200	54,000	2	
9	19¼	0.40*d*	1,400	140	45,000	5	[9]
11	16¼	0.39*d*	1,700	170	50,500	8	[10]

[1] Reset upper arc at 6,000 lbs. [2] Cord of upper arc touched at 7,000 lbs. [3] Center load, hence axis may not be correctly located. [4] Repeated loading. [5] No records for y_1. [6] Cord of upper arc touched at 25,000 lbs. [7] Cord of lower arc touched at 6,000 lbs. [8] Repeated loads and failed in shear. [9] Failed in shear. [10] Upper cord touched at 16,000 lbs.

TABLE IV.—Fiber Stresses According to Common Theory and Experimental y_1.

Beam.	Max. comp. in concrete, lbs. per sq. in.	Tension in concrete.	Tension in steel. lbs. per sq. in.	Remarks.
1	2,120		76,500	
2	2,380		76,500	
3	2,870		74,300	
4	3,100		75,500	
5	1,900		56,000	
6*a*	1,900		59,300	
6*b*	1,900		62,500	
6*c*	1,750		67,700	
6*d*	....	Concrete assumed to take no tension.	....	See Table III.
6*e*	....		....	
7*a*	2,000		66,400	
7*b*	2,000		62,000	
7*c*	2,000		62,000	
7*d*	1,800		55,500	
7*e*	2,000		60,000	
8	2,500		64,200	
9	1,750		52,200	
11	2,100		58,100	

Foreign Railroad Notes.

Just before the war broke out it was announced that the International Sleeping Car Company next summer would put on a limited train, with all luxurious appliances, to run weekly through without change from the Prussian border at Alexandrowo to the Pacific at Dalni, in 13 days and 2 hours, in connection with a train from Berlin and elsewhere in Western Europe. Leaving the Prussian border at 3.33 p. m., Friday, it would not reach the western end of the Siberian Railroad (Chelyabinsk) until 3.15 a. m., Tuesday, and thus would be 84 hours in crossing European Russia. Fare, 1½ times first class. If the war does not end soon we may assume that the time of putting on the train will be postponed. As such a train would be likely to have nearly all the passengers from countries west of Russia, it would seem that not many are expected, or it would run oftener than once a week.

A bill, it is reported, has been adopted by the German Bundesrath, and will be sent to the Reichstag, which provides for a loan of $2,000,000 to be guaranteed by the Government to build a railroad 76 miles long from Lome to Paline in Togoland, German West Africa.

The Prussian State Railroads have established a system of rewards for men engaged in making up trains in the freight yards, allotted for those who do their work with the least damage to cars.

The Milan Transportation Exhibition, which was first set for next summer, and then, on account of the delay in the construction of the Simplon Tunnel, was put off till next year, has been again postponed till 1906. The exhibition is to be in part a celebration of the tunnel opening, and though it remains possible that this may be as early as the spring of 1905, it is so uncertain that it is thought best not to hold the exhibition that year.

The Barge Canal Across New York State.

Work will soon be actively commenced in making the enlargement of the portions of the present Erie canal which are to be utilized in the new barge canal from Troy to Buffalo, in canalizing parts of the Mohawk river, and other waterways, and in digging those parts of the canal which traverse new territory. The accompanying plan shows the route of the barge canal, indicated by a heavy line, while the sections of the old Erie canal which do not coincide with the new route are shown by a lighter line. The New York Central and the West Shore routes through the same country are also shown on the map, and some of the most interesting problems connected with the canal location will be the avoidance of canal and railroad crossings where it is possible to avoid, and the planning of these crossings where it is necessary that they shall exist. The New York Central Railroad is working in perfect harmony with the canal board, and each of these organizations has appointed one representative to confer with the other on crossings and on other points where a change in the location of the railroad may be necessary.

As is shown on the map, the canal ascends from Waterford to Cohoes by means of a flight of locks, and runs thence in the Mohawk river to Rexford Flats and Little Falls, crossing the New York Central's main line near Schenectady and re-crossing it four miles east of Genesee street, Utica. From that point the canal runs north of Utica and crosses the New York Central again about two miles west of Oriskany, passing south of Rome to Fort Bull and thence down Wood Creek to Oneida Lake, running 19½ miles in deep water through this lake. Beyond Oneida Lake the canal follows the Oneida river with the exception of two large bends west of Brewerton to Three River Point, where cut-offs will be built. The route then runs up the Seneca river to the outlet of Onondaga Lake and continues west from this outlet along the Seneca river through Baldwinsville and through what is known as the State ditch at Jack's Reefs. From this point the direction is westerly, following the Seneca river beyond Savannah and parallel and running to the north of the New York Central. The barge canal joins the present Erie canal again about two miles east of Clyde with a change of about 4,800 ft. near Lyons, and runs thence along the present Erie canal to Macedon, with the exception of about half a mile at Newark. From here it follows the present Erie canal to a point half a mile east of Fairport, and then runs across country south of Rochester until it reaches the Genesee river near South Park. Here it crosses in a pool formed by a dam in the Genesee river, and, keeping to the west of the outskirts of Rochester, joins the present Erie canal again about a mile east of South Greece.

From this place the present canal will be enlarged, to a point near Medina, where there is a change in alinement of some 3,500 ft., crossing Oak Orchard Creek about 1,500 ft. north of the present location. From here to Lockport it follows substantially the present location, and so on to Tonawanda, with the exception of one or two changes in Tonawanda Creek. It enters the Niagara river at Tonawanda and continues in the river to the sloop lock at Black Rock harbor, Buffalo, and runs through this harbor and the Erie canal to the city of Buffalo.

It will be observed that the barge canal runs south of Rochester. To provide Rochester with a harbor the river will have to be canalized for nearly a mile, or to the mouth of the present feeder. This feeder, enlarged to proper dimensions, will then furnish a harbor at Rochester, the entire distance to be traversed on the additional strip of canal being about 2¾ miles. At Buffalo the new north breakwater, which has been described in the *Railroad Gazette*, now covers the gap between the old breakwater and Bird Island pier, so that it is practicable for canal boats coming up Black Rock harbor to make their way in thoroughly protected water to the Erie Basin. It is probable that Black Rock harbor and the present Erie canal will therefore be merged by the

removal by the United States Government of the present dividing wall.

The changes to be made will prove of special benefit to several cities along the line. For example, at Utica the new canal is laid out to the north of the city and accomplishes a long desired straightening of the river. A space will be left north of the New York Central's tracks 1,200 ft. wide on the average, and certainly four miles long, covering about 500 acres and providing advantageous factory sites. It is proposed to fill and level the old canal. At Syracuse it was suggested in the report made by Mr. Bond in 1901, when he was State engineer, that the railroad tracks can be taken off the city streets, where they have long been a nuisance and a menace, and placed in the old canal bed. Rome and other cities are also benefited to a greater or less degree by the changes. The removal of the canal from Syracuse does not affect the facilities of that city, which has access to it through Lake Onondaga. At this point the canal is about 4½ miles from the city.

Simultaneously with the building of the barge canal the location of the Champlain canal, running from Whitehall to Troy, is to be changed, and the canal is to be made of the same capacity as the barge canal to Buffalo. The present Champlain canal runs north on the west bank of the Hudson river above Troy to Northumberland, where it crosses the river, and from that point runs on the right bank almost to Fort Edward, diverging there and leaving the river. The new Champlain canal will run in the Hudson river to within three-fourths of a mile of Fort Edward and will then branch off into the old canal, which will be enlarged, as previously said, to the same dimensions as the barge canal. The Oswego canal, running from Oswego on Lake Ontario to the junction with the barge canal west of Oneida Lake, will also be changed to the same standard of size.

The canal is divided for purposes of reference and description into three arbitrary divisions. Division No. 1 extends from the Hudson river to deep water at the east end of Oneida Lake. Division No. 2 extends from this point to a junction with the present canal, 1¼ miles east of Clyde, and Division No. 3 covers the remainder of the canal to Lake Erie at Buffalo. A considerable part of the 1901 report is devoted to the two concurrent problems of getting enough water in the canal at the dry seasons of the year and of avoiding getting too much water at the wet seasons of the year. With regard to the first of these problems, that of water supply, Lake Erie will be depended on as far as Savannah, 139 miles, since with the former Erie canal it was found impossible to provide more than a few relatively small feeders between these points. Beyond Savannah, the Seneca river furnishes an abundance of water up to its junction with the Oneida river, and the next section of the canal, through Oneida river and Oneida Lake, is fairly well supplied by the drainage from an extensive tributary water-shed independent of the supply derived by lockage, etc., from the Rome summit level. Hence, from Buffalo as far as New London, 217 miles east, or nearly two-thirds of the total distance, there is no serious difficulty.

From New London east to Herkimer the situation is quite different. In this region there are no large streams, so that the summit level must of necessity be supplied from a number of sources with artificial storage in order to obtain the requisite quantity of water. Moreover, nearly twice as much water is required here as would be needed for the same length of canal if it extended in only one direction, for, as the profile shows, water for lockage and leakage has to be drawn from each end of the summit level. It has been decided that the most economical solution of this problem is to build several large storage reservoirs on streams within comparatively easy reach.

East of Herkimer numerous large tributaries enter the Mohawk and in the 81-mile section from Herkimer to Cohoes the water supply is ample.

In providing for floods in the spring the calculation was chiefly based on known high water marks of characteristic portions of the waterways traversed. In some cases, very little reliable data could be obtained, and it appears to the reader that the flood estimates for portions of the route may perhaps not be entirely reliable, but it is equally true that the damage done by floods to those parts of the canal which run through existing waterways will probably not be very great, especially in view of the fact that the worst and practically the only flood season comes prior to the spring opening of the canal. As regards the chance that such floods in the Mohawk should cause a discharge beyond the liberal allowance made, it was not believed by the State engineer that the remote possibility of the occurrence of such floods beyond those expected in the closed season, would sufficiently justify the large outlay needed to provide for them. The risk of the expense involved in possible repairs, together with temporary interruption of navigation in case such floods should come later than usual in the spring, is believed to be preferable to a large original outlay with accumulated interest on the investment. The upper ends of locks and other structures, as estimated, provide for a rise in the water surface 2½ ft. higher than the flood heights which may be expected at long intervals during the closed season of the canal. In view of this, it is not believed that these structures would be apt to suffer any injury even in times of maximum floods. The general flood conditions in the Oswego, Seneca and Oneida rivers are the same as in the Mohawk, and the same rule has been applied.

The flood conditions in the Hudson river above Troy, where it is utilized by the new Champlain canal, are better known than those of the other rivers because better records have been kept. Since 1869 the maximum flood recorded at Mechanicville gave a discharge of 59,393 cu. ft. per second. This occurred in 1896. A discharge of 60,000 cu. ft. per second has been provided for in the new Champlain canal and, as in the Mohawk, it has been decided that the cross section of the canalized river should be such as to pass the greatest probable floods during the period of navigation at a rate not to exceed 4 ft. per second. When extreme floods occur in this part of the country, it is nearly always in April, and the records at Mechanicville do not show a flood flow much exceeding 30,000 cu. ft. per second at any other season. Therefore, the cross section of the canalized Hudson river has been estimated at a size to pass a discharge of 30,000 cu. ft. per second at points below the mouth of the Hoosic river and 25,000 cu. ft. per second above. The following tables show the physical characteristics of the canal:

Alinement of Barge Canal—From Congress Street, Troy, to Fort Porter, Buffalo.

	Length, miles.	Per cent. of total.
Open water	23.49	6.8
Tangent	211.47	61.7
Curve, 0° 30′	2.10	0.6
1° 00′	15.47	4.5
1° 30′	8.40	2.5
2° 00′	27.11	7.9
2° 30′	4.91	1.4
3° 00′	16.31	4.7
3° 30′	4.65	1.4
4° 00′	27.76	8.1
4° 30′	0.19	0.1
5° 00′	0.67	0.2
6° 00′	0.13	0.1
Total	342.66	100.0

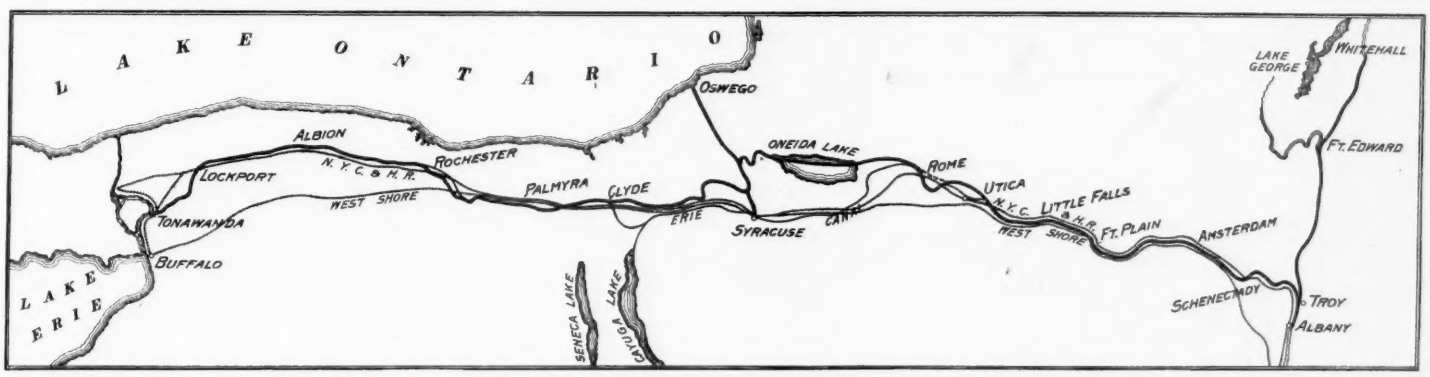
Characteristics of Cross Section, Barge Canal.

	Length, miles.	Per cent. of total.
Standard earth, 75 ft. section	130.44	38.1
Standard earth, 94 ft. vertical sec.	8.20	2.4
Standard earth, 90 ft. vertical sec.	2.54	0.7
Standard earth, 80 ft. vertical sec.	0.24	0.1
Standard earth, 75 ft. vertical sec.	2.14	0.6
Combined earth and vertical section	7.31	2.1
Locks and approaches	16.96	4.9
Canalized river, 200 ft. or over	147.17	43.0
Open water	27.66	8.1
Total	342.66	100.0

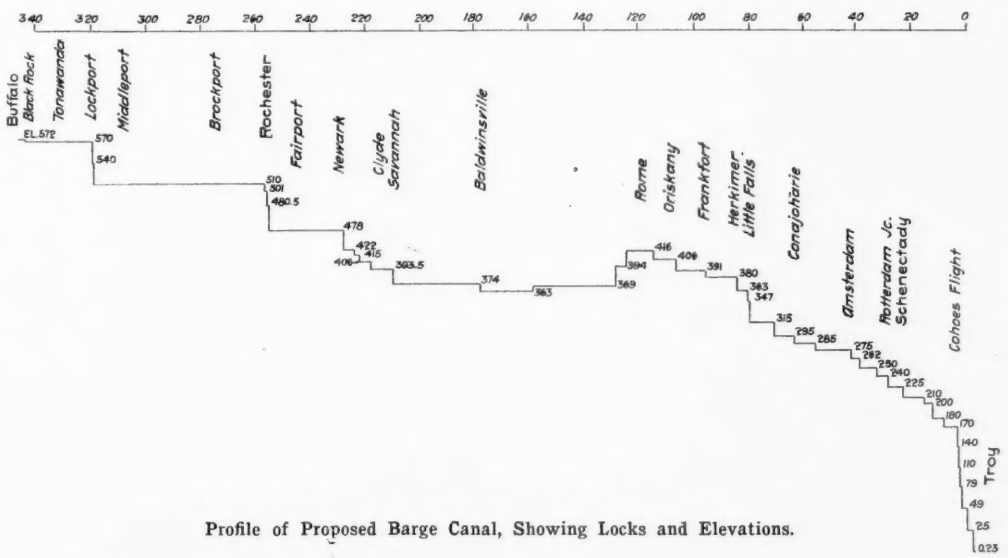
The advantages accruing from the choice of the Mohawk river as a route, so far as feasible, for the barge canal, are thought to be numerous. In many instances problems of bridges, railroad crossings and the crossings of water courses are thereby avoided. Moreover, the maintenance expenses of a canalized river should be considerably less, in the opinion of Mr. Bond, than the maintenance of a built canal, and there is little, if any, risk from leakage and from breaks. Navigation in a canalized river is less restricted than in a built canal, no special consideration needs to be given to abutting property in making the changes, and it is readily possible to increase the size of the prism in case such increase is ever called for. The localities through which the canalized river passes also derive an advantage in additional city water power from the ponds backing up the frequent dams at the locks.

The standard barge which can traverse the canal will be of 1,000 gross tons maximum, as provided by law, allowing a load of, say, 840 tons of grain. The locks are adapted to containing two barges at the same time, each barge being 150 ft. long, 27 ft. wide, and about 11 ft. deep, leaving 1 ft. clearance over the sills.

The changes which have thus far been planned by the New York Central provide for the re-location of part of the Troy & Schenectady branch. The canal will pass under the Mohawk branch of the New York Central at Schenectady, involving modifications, and also at Hoffman's. There will have to be some radical treatment at Utica, where the railroad tracks are at present on quite low grade, and there are two crossings. It is probable that the railroad will have to be raised about 20 ft. at this point. Beyond Utica the tracks will remain on the north of the canal as far as Rome, where there is another crossing, and from here to Clyde they are continuously on the south. The canal again crosses the tracks at Clyde, and, generally speaking, runs very close to the main line, and will probably continue on the south of it for the remaining distance to Rochester. There is a crossing at Rochester and then no further difficulty to Lockport, where there is a crossing, and another crossing at Tonawanda, as may be seen on the map. The two heaviest portions of the work, so far as changes in railroad location are concerned, will be at Utica and at Rome. At Utica, as mentioned above, a high fill and a long approach will probably be necessary. At Rome it is rather probable from present indications that a slight change will be made in the canal route, as indicated by dotted lines on the map, avoiding two crossings which would otherwise require a considerable fill.



General Map of Proposed Barge Canal, Divergent Portions of the Erie Canal Shown by a Lighter Line.



Profile of Proposed Barge Canal, Showing Locks and Elevations.

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EDITORIAL ANNOUNCEMENTS.

CONTRIBUTIONS.—Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

ADVERTISEMENTS.—We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay, EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and these only, and in our news columns present only such matter as we consider interesting and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers, can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially either for money or in consideration of advertising patronage.*

The Westinghouse single-phase motor, described in this issue, promises to overcome the limitations inherent in both direct and multiple-phase alternating current systems for long-distance electric railroading. As yet, no practical demonstrations of the utility of this motor have been made, but the enthusiasm and confidence of the builders in its possibilities give that much assurance of success. It well may be that other types of single-phase motors will be developed, but the important thing to be noted is that the day is not far off when this type of motor will be used as a practical means of securing the advantages of electricity for railroad service. In general design the new motor does not differ greatly from series wound direct current motors. It is claimed that by a simple change in the controller, the motor can be operated by direct current. This is an important feature especially for such roads as the New York Central, which will have terminal connections with existing lines in New York City operated by direct current. The efficiency of the single-phase motor operated by direct current would, of course, not be as great as the efficiency of a direct-current motor, but the advantages gained by the use of single-phase alternating current on the long-distance runs, due to the elimination of rotary converter stations, reduction of transmission losses, etc., will more than offset the loss of efficiency within the direct-current zone.

Suit has been begun by E. H. Harriman, Winslow S. Pierce and the Oregon Short Line against the Northern Securities Company, opposing the proposed pro rata distribution of Northern Pacific and Great Northern stock to holders of Northern Securities stock. Out of a total of $155,000,000 of Northern Pacific stock deposited at the time the Northern Securities Company was organized, $78,000,000 was deposited by the Harriman-Union Pacific interests; an amount which carries control. But the terms of the proposed distribution provide that the returned stock delivered to holders of Northern Securities shall be apportioned on an equitable basis between the two constituent properties which went into the merger; the Union Pacific interests would hence receive a large minority share of Northern Pacific and also of Great Northern, which latter they did not previously possess, but they would not come into control of either road. Mr. Harriman has opposed from the first the joint distribution of the two stocks, and the present suit tends to reopen the Northern Pacific controversy of 1901, except that it will presumably be fought out in the courts, instead of in the stock exchange. It is claimed by the petitioners that the decision of the Circuit Court on June 7, 1903, directed that the stock be returned share for share, and that the plan proposed for a pro rata distribution would leave control in the hands of the same people who now control, and would defeat the ruling of the Supreme Court. The Hill-Morgan proposition to redeliver the underlying Northern Securities stocks in such a manner that they should still retain control after the dissolution of the merger company would have been an exceedingly clever solution of the problem of retaining unity of interest in the operation of the lines involved, had it not been contested. But it was scarcely to be expected that the Union Pacific would stand quietly by and see its majority holding exchanged into the joint delivery of Northern Pacific and Great Northern. Therefore a unique situation arises. Presuming that the case is appealed to the Supreme Court, it would appear that this body must in either case give a decision which will leave one interstate road in majority control of another parallel and competing line. If the petitioners win their case, control of the Northern Pacific will rest with the Union Pacific, or Harriman, interests; if they are defeated, it will rest with Messrs. Hill, Morgan and the Great Northern. Having removed the bugbear of the holding company, it would appear that the Supreme Court, whichever way it turns, must find itself in the position of fortifying an effectual combination in restraint of trade!

Viewed as a question of economics, there has been a clear divergence of opinion as to the profit of enlarging the Erie Canal and of canalizing Lake Oneida and portions of the Mohawk River so as to form a canal through which 1,000-ton barges could pass from Buffalo to the Hudson. The *Railroad Gazette* took occasion last fall to express fully its belief that the proposed improvement was inadvisable, for reasons which need not here be repeated. But when the shareholders of the State of New York announced their decision at the polls, last November, the economic part of the question ceased to be debatable, and the proposition thereby became entirely one of engineering. The problem which now confronts the canal board is of fascinating interest. A navigable waterway 350 miles long must be provided, not less than 123 ft. wide and 12 ft. deep. It must be free from disturbance by freshets in the spring and by droughts in the summer, and there must be no waste or damage by leakage through the banks or at the locks. The fall of the canalized portion of the Mohawk River between Rome and the Hudson at Cohoes is 400 ft. so that the river will have to be transformed into a series of ponds, with a lock at each dam. Preliminary comment is made in another column on the layout of the barge canal, with special reference to the relocation of certain parts of the New York Central which it involves. The route of the canal has been prescribed by legislative act and will be subject only to slight variations, but many, if not most of the lesser problems, have yet to be worked out, and the actual work has not progressed much beyond the period of surveys. Both in the matter of engineering and of construction, the barge canal will offer a field for monumental work, and it is in able hands.

The power of the advisory board is indicated by its title. It is purely advisory as regards its authority over the State engineer, giving him professional advice whenever he may request it or when the board deems proper and advisable. The duty of the board is also to report upon the work to the Governor for the purpose of keeping him advised as to its character and progress, and it must keep itself fully informed as to the progress of the work, which will, of course, include the letting of contracts. If the board, being fully informed, does not advise the Governor of improper contracts or improper work, it is presumptive evidence that the board is fully satisfied with the manner in which the contracts are awarded and the work performed. Even though the authority of the board is indirect, therefore, its moral effect should be very great in the prevention of the kinds of "graft" with which New York State is familiar, together with other new kinds with which it is not yet familiar. The board has no autocratic authority in regard to discharging men, for example, but it is its duty to be fully informed as to the manner in which the works are directed, and if the attention of the State engineer or of the Governor should be directed to a State employee of whom the advisory board did not approve, such disapproval would necessarily result in investigation. In this way the responsibility for the proper letting of the contracts and the proper conduct of the work, will after all, rest practically on the advisory board. The State is extremely fortunate in the personnel of this board, and the chief, Mr. Bond, combines in a rare degree the qualities of capability, breadth of view, and a downright honesty that is exceedingly satisfying and reassuring.

The Limitations of Discipline.

The records of past years tell us the number of hundreds of persons killed, of the thousands maimed and the millions of dollars cost of train wrecks, and we can foretell for the coming year with considerable accuracy the killing, wounding and waste due to the familiar causes. We call them accidents, but when the sum of them can be foretold with such precision, they surely are not "events which take place without one's foresight or expectation." They are, rather, blunders, and if they were so listed and treated as the dictionary defines them, "events resulting from carelessness, stupidity, or culpable ignorance," it might have the psychological effect of presenting more definitely a problem for solution, instead of a condition to be endured. It is a general opinion, and probably the opinion of every man of a generation of experience in any department included in Conducting Transportation, that the carefulness, alertness in emergencies, and general efficiency of trainmen has decreased somewhat in proportion to the perfection and introduction of safety devices. If this is true, and it is believed to be true, it is due, not to one, but to a variety of causes.

The use of automatic couplers and stronger cars seems to have accompanied with equal step greater recklessness and greater destruction in yards. The use, at least the early period of use, of automatic signals, interlocked switches and signals and effective brakes is believed by many superintendents to lessen the vigilance of the enginemen. The departmental system of organization, primarily designed to assign to specialists the work for which they are best fitted, seems to work out so that division officers have a lessened feeling of responsibility for the net results of the operation of the division, although they get more prodding. The divisional organization assigns to the division officer such an increased variety of duties, involving a pretty full detailed knowledge of the economical use of power, engineering and maintenance of way, that days are not long enough to do as was done in the old time; to know the customers of the road and study and develop the local business; to know his own men and keep them up to the mark. With higher speed and heavier and more frequent trains the division officer's time is more and more demanded and devoted to keeping the road open and the wheels turning, and proportionately less time is left for inspection and punishment and teaching.

There is no reason for thinking that any new principles need to be discovered and applied as a remedy. An intelligent groceryman who employs one clerk soon learns that trained men are made—not born. He learns that patient teaching, admonition and punishing will get good service, even from a dull man, if he has ambition to do good work and is honest; and that lacking these qualities quick discharge is the only remedy. This is quite as true of every man in the operating department of a railroad as it is true of the groceryman's clerk, but in the nature of things a large body of men cannot have quite such close watching; nevertheless it can be approximated.

Inspection and surprise testing, something like that devised by Mr. Kruttschnitt for the Southern Pacific, and described in these columns last week, is shown by its results to be necessary, quite as necessary as is the disagreeable business of spotting conductors. It may be conducted by a headquarters bureau, as on the Southern Pacific, or by the division superintendents, but in either case it should be borne in mind that this is simply the detection of culprits. It is educational only so far as it makes men afraid and it is not reasonable to suppose that the fear of Hell is inspiration to all of those who seek Heaven, although it helps much. Fear works well in making the whole track force to turn out at night in a heavy storm; to make the rear flagman do his whole duty; and in general to enforce the observance of the whole code of rules; but unaccompanied by personal attention and teaching it makes men nervous and, in many cases, liable to blunder simply because they are afraid. A hand car was hit by a train, and undue severity in treatment of the case undoubtedly caused the several like cases which quickly followed, and with the added bad result that the section men were much less efficient. They spent too much time outside the ballast line.

The superior officer's interview, by special appointment, with a subordinate who has been at fault, com-

monly called "a jacking up," is too often capable of improvement in method. It should be a "sifting out the hearts of men before the judgment seat," and both in form and in substance no better model can be found than the kindly severity, humanity and dignity of a wise judge. Humiliation is temptingly easy, but it is difficult to find many cases where it does good. The officer who "gets mad and reads the riot act" is not, while doing so, making money for the company, although he may be extremely valuable at other times.

The Standard Code is as complete a prescription for safe train movement as great transportation officers could make it after years of study. Its absolutely strict observance, combined with the highest efficiency in the engineering and mechanical departments, makes train disasters impossible, except such as may be due to a convulsion of Nature. But the strictness of that observance is subject to the variations of the individual. Like the groceryman's clerk, every man having to do with train movement must be taught always, always inspected; and there must be weeded out those lacking in that wonderful, but wonderfully common, ability to do the same thing in the same way safely a million times without error. This is the problem, unchanged during seventy-five years of railroading, and not only unsolved, but resulting in a situation becoming more and more acute and disastrous while every other department of the art of transportation advances by strides.

That the solution of the problem involves a change from past methods is conclusively proved by the failure of every method heretofore tried to accomplish enough. The object of this writing is simply to state the principle and present the problem a little more clearly, and also to suggest some of the directions in which the remedy may be found. It is possible that an extension of the Southern Pacific's headquarters inspection system to a bureau large enough to include personal observance, teaching, admonition and weeding out may, on some roads as they are now organized, get the desired results. It may be that shorter divisions, involving more division superintendents, may enable a competent officer to get around oftener and stay longer among his men, and know their characteristics in the old-fashioned way. Perhaps the same result can be got by giving a division officer an understudy, not an assistant, but a man in training who is as far as possible a substitute while the boss is away, and who is generally out on the line while the boss is in the office. This we understand to have been pretty well worked out on the Baltimore & Ohio. An understudy does not get a high salary; he lives partly on hopes. "How long since you have seen the boss?" This is a good question to ask a station agent, for by just so much as a good boss is seen, and increases his seeing, the improvement in discipline can be measured.

The report of the Massachusetts Highway Commission, which is printed in part elsewhere in this issue, is gratifying, as usual, in the example it gives of healthy and efficient management of the business entrusted to it by the Commonwealth. State commissions, like state legislatures, are prone to have their time much taken up with devious things, but in Massachusetts it is not even considered unusual that a commission should be seriously occupied with the work apportioned to it. The Highway Commission is not yet ten years old, but it has already completed 482 miles of good roads, an enterprise to which tribute has recently been paid by the action of the Illinois Central, the Southern, and other railroads, in sending good-road trains through the south. The reluctance of the farming communities to aid in good road building is due, for the most part, to ignorance. They scarcely realize that the prosperity of a community depends, in a large part, on the ease with which its products may be carried to market. Their fathers and grandfathers have used muddy roads all their lives and they are perfectly content to continue in the same rut. The scheme, as worked out by the Massachusetts Highway Commission, is to overcome this halting tendency by trying to stimulate a sort of local pride. The Commission does not build a large amount of continuous improved road in one locality, but puts in a few miles each year in widely scattered districts. In this way, the interest in the various communities is often aroused, and an attempt is made by the town or village to add a little at the town's expense to the good roads built by the Commission.

The Chicago Coal Shippers' Association proposes to try the Anti-Trust Law on the Chicago Car Service Association (demurrage bureau). Whatever may be said of the legality of the doings of the bureau or the expediency of enforcing the law, provided it can be enforced, there is no question that the coal dealers know how to define their grievance in the most effective way. Their bill, which is to be heard in the United States Circuit Court, April 15, declares—

"That May 1, 1902, the 26 companies (which are named) in order to 'restrain trade and destroy competition among themselves' and to 'counteract the effect of such competition on the quality of the service rendered,' did 'unlawfully conspire and agree together to enter a written contract.'

"That the defendant railroads have refused to take shipments of freight unless the shippers agree to be governed by the association rules and rates.

"That in case a shipper refuses to comply with this requirement, his name is stricken from the credit list of all the roads holding membership in the association. Unless the shipper at once pays such charges as the association may deem proper the companies will refuse to switch cars to the shipper's tracks.

"That commerce would remain in free and unrestrained competition but for the contract between these roads.

"That by one of the terms of the contract a manager elected by the association is 'granted plenary and arbitrary power' to make rules for the companies and for the public and to apply them according to his judgment. That in so doing the railroad corporations have surrendered to the manager the work of construing and applying the terms of their dealings with their shippers, and that they have therefore no further right to make contracts regarding the handling of freight.

"That the companies named 'give out and pretend' that it is beyond their power to allow more time for unloading and transferring than the contract provides, or for them to deliver goods until the accrued storage charges have been paid.

"That the elimination of individual action on the part of the railroad companies operating within the territory affected by the agreement works an injury to shippers, because in the free play of competition better service would be received in the provision and transportation of cars."

And, finally, it is alleged that these things establish the fact of violation of the Sherman law.

As to whether the anti-trust law, strictly construed, applies to a railroad agreement which may affect competitive prices, even remotely, there can be no question. Justice Peckham's Trans-Missouri decision would put a freight agent in prison for agreeing with the agent of a rival road to close the freight house doors 15 minutes earlier at night, to please a labor union; for if the door-closing agreement did not exist, competition would be slightly more unrestrained. But Justice Brewer's recent opinion in the Northern Securities case indicates that henceforth the reasonableness of agreements will be taken into consideration, and so we may expect a discussion of the demurrage agreement on its merits. Four of Justice Brewer's associates holding one view and the other four an opposite one, "what Brewer says goes," and if the demurrage agreement is beneficial to freight traffic generally it should stand a good chance of being sustained. On the reasonableness of a demurrage charge *per se* the Illinois Supreme Court has recently laid down some sound principles of law (*Railroad Gazette*, March 18, page 213); and that demurrage cannot be collected in Chicago without a restraining agreement must be apparent to a Chicago judge, almost without testimony. If there is a place in the world where competition between freight agents is riotous and destructive Chicago is such a place. If there is any kind of freight competition more difficult than other kinds to regulate and more elusive of control, demurrage is one of that kind, and therefore demurrage is a matter in which an agreement is justifiable if one is justifiable anywhere. It is to be hoped that the issue will be joined, and that the suit will be carried up far enough to secure a thorough judicial study of the whole subject. Demurrage regulations have their difficulties and defects, and, like pooling, they are not a complete remedy for the evils that they are applied to; but the experience of 15 years has shown that the car service associations are a great benefit to both the public and the railroads.

The recent attempt which has been made by Secretary Taft to interest capital in building a system of railroads in the Philippines is, without doubt, one which deserves thoughtful consideration, although the prospect of immediate success is not altogether favorable. It is undoubtedly true that the islands possess large, fruitful areas which could be turned to profitable advantage by better transportation facilities, and in his report, made some time ago, on the condition of the islands, Mr. Taft called attention to the fact that the Manila & Dagupan Railroad, 122 miles long, on the island of Luzon, was the only railroad in operation. He said further that this road, which was built in 1892, was hardly a fair test of whether or not a railroad might be profitable in the islands, as it was a 3-ft. gage line improperly located, crossing near their mouths a number of streams which often overflowed and damaged the roadbed. This railroad has not proved to be a dividend-paying investment, although it has undoubtedly been of great benefit to the provinces through which it runs. The fault does not lie so much in the resources of the country, nor in the poor construction of the railroad, as in the sluggishness of industrial development in the islands. That a new railroad can be successful in localities in the Far East where the tendency is toward social improvement and industrial development, has been proven in Japan, but it is apt to be unprofitable business to build railroads much in advance of industrial development and as a means of promoting such development. How soon this stimulating influence in industry will come and by what means it will be started are questions which no one can answer; but if it does come, as Secretary Taft thinks it will, railroad building in the Philippines should be commercially successful. The islands have great wealth waiting for the hand of civilization and for transportation to carry it to the coast, and the cocoanut industry and the large tobacco plantations alone, with their present slow means of transportation, offer undeveloped fields for railroad building.

NEW PUBLICATIONS.

Compendium of Drawing. Compiled from the courses of the American School of Correspondence at Armour Institute of Technology, Chicago. Two volumes, 898 pages, size 7 x 10. Cloth, $8. Single volume, $5.

Part I consists of seven of the 45 regular instruction papers in the architectural course, and Part II consists of five of the 44 pages in the mechanical engineering and sheet-metal pattern drafting courses, of the American School of Correspondence of Armour Institute of Technology. The primary aim in issuing these selected papers in this form is to acquaint the public with the standard, scope and practical value of the courses they represent. They not only serve this purpose well, but contain a considerable amount of information serviceable alike to draftsmen, students and teachers.

The papers are prepared by acknowledged authorities in the subjects dealt with, a goodly proportion of those included in these two volumes being by members of the faculty of the Massachusetts Institute of Technology. The subjects covered by the 12 papers are: mechanical drawing, machine design, sheet-metal drafting, shades and shadows, pen and ink rendering, perspective and architectural lettering. The papers give evidence of care in their preparation. The explanations are clear and concise, yet comprehensive, and it is apparent that their authors had constantly in view the fact that they are primarily for the use of students unaided by the direct assistance of a personal instructor. A proper study and comprehension of these papers should ground the student well in the subjects treated.

The arrangement and construction of the books is good. The printing is in large clear type and the engravings, of which there are over 1,000, including full-page plates, sections, diagrams and folding plates, are clear, well executed and are conveniently placed in relation to the text references. Lists of examination questions for the different papers are included, and both volumes are indexed.

Manual of American Street Railways. Published by Poor's Railroad Manual Company, 68 William Street, New York.

This is a special edition containing a list of all street railways and traction lines (city, interurban and suburban) in the United States. Besides the data which was published in the thirty-sixth annual number of Poor's Manual of Railroads, the new publication contains a table of statistics of all the electric railroads in the country, showing the total distribution of mileage, equipment and capitalization of each. This table is carefully compiled and should prove of great value to statisticians, being the first satisfactory compilation of street railway statistics which has been made, with the possible exception of the 1902 census report, which loses much of its value because we cannot expect to see it brought up to date at annual intervals.

TRADE CATALOGUES.

Catalogue No. 4 of the Thew Automatic Shovel Co., Lorain, Ohio, describes steam shovels, excavators and dredges. Each type is shown in a full-page half-tone engraving, the facing page having a brief description and the principal dimensions of the machine. Four types of shovel, three types of excavator, and a 1-yd. dipper dredge are shown. Illustrations are also given of the several types of machines engaged in different sorts of special work.

Supreme Court Decision in the Anthracite Coal Case.

In a decision by Justice Day the Supreme Court of the United States on Monday last granted the application of the Interstate Commerce Commission for an order to compel the anthracite coal roads to produce certain agreements affecting rates on coal from the mines to the Atlantic seaboard, which were refused when the Commission held its inquiry into that subject in New York City several months ago. The case arose on a complaint filed by W. R. Hearst in 1902, against the Reading, the Lehigh Valley and the other anthracite carrying roads, and it came up on appeal of the Commission, the Circuit Court in New York having decided that the documents need not be produced.

The Supreme Court decides, first, that it has jurisdiction and, second, that the complainant should be heard, notwithstanding that Mr. Hearst had sustained no damage. The Circuit Court had held that the facts in the agreements called for were irrelevant to the question of the reasonableness of transportation rates. Justice Day says that the coal purchase contracts were made with coal companies owned principally by the railroad companies, and fixed the price of anthracite, shipments to be made as called for by the purchasers. While the contracts were produced for inspection, the witnesses refused to permit them to be given in evidence. In the decision Justice Day said:

"The railroads are all engaged in interstate commerce, and into their affairs and methods of doing business the commission sought to and is lawfully authorized by the commerce act to make investigation. The commission has the right to know how interstate traffic is conducted, the relations between the carrier and its shippers, and the rates charged and collected. We see no reason why contracts of this character, which have direct relation to a large amount of carrying trade, can be withheld from examination as evidence by the commission.

"It is to be remembered that we are not dealing with the

ultimate fact of controversy or deciding which of the contending claims will be finally established. This is a question of relevancy of proof before a body not authorized to make final judgment, but to investigate and make orders which may or may not be finally embodied in judgments or decrees of court. It may be that the commission or the courts will ultimately find that these contracts do not fix the compensation received by the carriers, and that, as claimed, the full rate is paid by these purchasing companies, and if there is a loss on these contracts it is made up on other business; but the question concerns the relevancy of proof, and not whether it finally establishes the issue made one way or the other. The inquiry of a board of the character of the Interstate Commerce Commission should not be too narrowly constrained by technical rules as to the admissibility of proof."

As to the Temple Iron Company contracts the court said:

"It is argued that these contracts, if given in evidence, will tend to show a pooling of freight in violation of the fifth section of the commerce act. While this testimony may not establish such an arrangement, it has, in our opinion, a legitimate bearing upon the question. There is a division of freight among several railroads where, by agreement or otherwise, the companies have a common interest in the source from which it is obtained. Furthermore, we think the testimony competent as bearing upon the manner in which transportation rates are fixed, in view of determining the question of reasonableness of rates into which the commission has a right to inquire. Unreasonably to hamper the commission by narrowing the field of inquiry beyond the requirements of the due protection of rights of citizens would be seriously to impair its usefulness and prevent a realization of the salutary purposes for which it was established by Congress."

Justice Brewer dissented, but did not deliver an opinion.

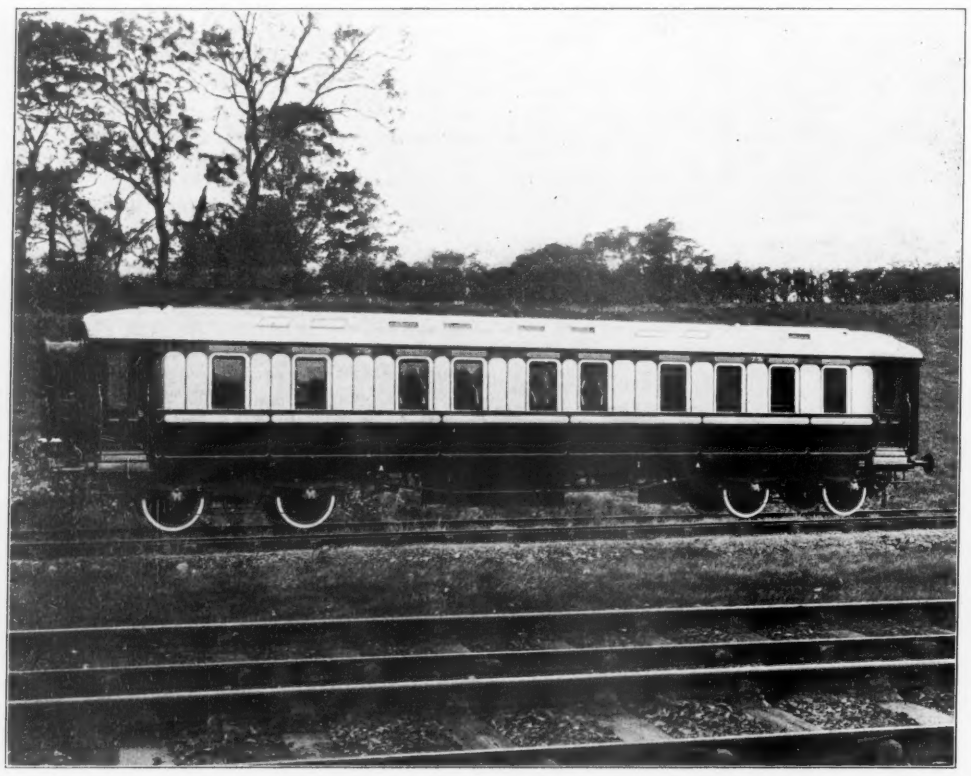
Foreign Railroad Notes.

The first statement of traffic over the Chinese Eastern Railroad comes from a newspaper in Kharbin, and is for the first 11 months of 1903, during which 1,620,000 passengers were carried and 313,811 tons of freight. Of the freight 32,522 tons were tea and 92,730 tons grain—equal to 3,090,000 bushels of wheat. The freight traffic was 52 per cent., the passenger traffic 69 per cent., and the gross earnings 55 per cent. greater than the year before, amounting to $5,612,389, which is $3,561 per mile for the 11 months—which is not so very bad, for a railroad not quite complete. From the same source comes a statement of the number of employees—20,948 Chinese, 18,123 Russians, 17 Austrians, Italians and Swiss, 17 Japanese and 9 Koreans, or 39,112 in all, which is more than 25 per mile. Doubtless most of these were engaged in construction; so many could not be used in working a line with so little traffic.

The fuel for the 2,000 miles of the Siberian Railroad west of Irkutsk is supplied by Siberian mines, and chiefly from two localities, one near the middle point of the line. Here (Sudshenka) the coal is very good, coking freely and with 7 to 11 per cent. of ash; but the coal seams lie deep and are thin and there is much trouble with water. The other mine is not far from Irkutsk, where the coal seams are 6 ft. thick or more and only about 80 ft. below the surface. But this (Cheremkhov) coal has 15 to 20 per cent. of ash. The ease of mining it, however, has caused it to be used to a considerable extent even west of the Sudshenka, and to some extent on the extreme western section of the road, nearly 2,000 miles from the mines, with, of course, great expense for transportation. The cost of Siberian coal on cars at the mines is $2.15 per ton. On the western end of the road some coal from Ural mines is used, but it contains so much sulphur that it is avoided as much as possible. Other coal mines have been discovered which may hereafter serve as sources of supply, but they are not as yet developed.

New Passenger Cars on the London & North-Western.

The London & North-Western has recently built at its Wolverton Works six handsome passenger cars intended to run in the royal train with the King Edward VII. and Queen Alexandra cars, described in the *Railroad Gazette*, May 22, 1903. They were made from designs prepared by the company's Chief of Car Construction, Mr. C. A. Park, and have the same general dimensions as the two royal cars, being 57 ft. long over platforms, 61 ft. long over buffers, 9 ft. wide and 12 ft. 7½ in. from top of rail to top of roof. The body of the car is carried on a steel and iron underframe, mounted on L. & N. W. standard 4-wheel trucks having an 8-ft. wheel base. The body framing is teak and oak paneled with Honduras mahogany and the exterior is painted in the company's standard color, lake for the bottom panels, French white for the upper panels, with the mouldings lined out in gold.



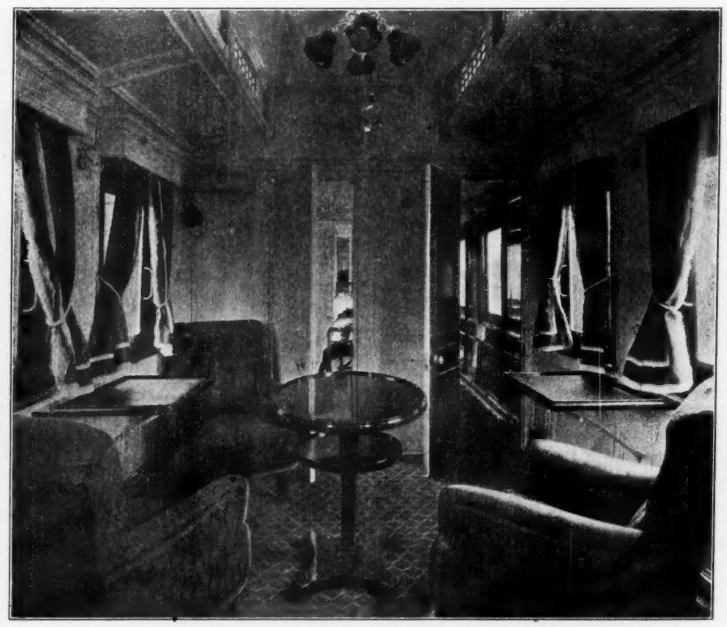
Exterior of New Passenger Coaches for Private Use—London & North-Western.

The car is divided into four compartments and can readily be arranged for either day or night travel. Two of the compartments, located one at each end of the car, are 8 ft. long by 6 ft. 3 in. wide and the other two in the middle of the car are each 8 ft. 6 in. long by 8 ft. 3 in. A narrow corridor runs along one side of the car at each end and opens into the large compartments which occupy the whole width of the car. The division between the two center compartments consists of a pair of double folding doors which may be folded on each other back against the sides of the car, thus making one large room, the whole width of the car and 17 ft. 2 in. long. There is an attendant's compartment at one end and a lavatory opening off of each of the smaller compartments, which may also be entered from the corridors.

When fitted for night travel, each compartment is furnished a brass lacquered bedstead with box spring mattresses complete and the necessary bedding; two Chippendale chairs, inlaid; and a side folding table between, covered with embossed green Morocco leather. For day travel the furnishings include three large lounging chairs upholstered in green and gold tapestry; one oval center table of inlaid mahogany and the folding side table also used at night. In the small compartments only two chairs are used, somewhat smaller than those in the center of the car. In the decorations, green, gold and white are the prevailing colors. All of the paneling is in plaque form, enameled white. The floor is covered with green and gold figured Wilton carpet and the window shades and hangings are in harmonious colors.

The cars are lighted throughout by electricity, the current being taken from dynamos driven from the axle. Each compartment has electroliers in the center of the ceiling and also ornamental corner bracket lamps. Provision is also made for an electric stove or heater in the attendant's room. Electric fans are mounted over the doors on the partitions between compartments. A high-pressure system of steam heating apparatus is provided having small pipes along the sides of the compartments and corridors next to the floor which are covered with ornamental cast covers lacquered to match the interior decorations. Combined Westinghouse and automatic vacuum brakes are applied.

These cars provide a large, handsomely and luxuriously furnished drawing-room compartment in which a number of persons may travel together during the day and which may readily be converted into two separate sleeping rooms containing two beds each for night travel and thus giving, with the two smaller compartments, four separate sleeping rooms. When not in use in the royal train these cars will be available for private parties on payment of a slightly increased charge over and above the usual rate for a private car. In every detail of comfort and convenience they are quite equal to any cars now available for private use on American railroads.



Interior of New Passenger Coaches—London & North-Western.

Massachusetts State Roads.

The eleventh annual report of the Massachusetts State Highway Commission shows that $550,000 was spent during 1903 for building and maintaining state roads. Of this amount, $100,000 was available through an act passed on April 1, 1903, and $450,000 was part of a sum of $2,250,000 which was voted for the purpose by the State Legislature on April 30, 1903, with the stipulation that not more than $450,000 should be spent in any one year. During 1903 additional layouts were made aggregating 74 miles, and the actual number of miles completed was 67, bringing the total mileage of state roads up to 482.

It is interesting to note that the number of new petitions during the year for the location and building of new roads was 43, making a total of 646 petitions, which cover over 1,663 miles of road, coming from 282 separate towns and 25 cities. According to the provisions of the statutes every county must pay the state one-fourth of the amount expended for new roads in that county, and $143,351 was assessed in this way during 1903. The law also requires that each municipality shall pay a sum not exceeding $50 per mile towards the maintenance of the state roads. The total cost of repairs in 1903 was $55,082, of which $18,750 will be paid to the state treasury by this means of assessment. The maintenance of the roads is under the personal charge of one member of the Commission, who goes over the ground frequently and lets the necessary work out to contract. In maintaining the roads during the past year a good deal of resurfacing was done, chiefly with trap rock.

In place of the telford foundations, which have proved unsatisfactory, the Commission has adopted, during the past two years, a V-shaped drain. In building this type of road the earth is loosened and thrown out toward the sides, so as to give a longitudinal V-shaped trench. Narrow cross trenches are cut through the sides of this center trench at intervals of 50 or more feet, connecting its lowest part with the gutters on the sides and placed at such a depth and slope as to remove all water. The center

and cross trenches are filled with wall stone, the thickness of which depends upon the character of the soil in the sub-grade. The Commission has found that this type of drain is more efficient and preferable to telford. It is much cheaper. The telford foundation costs $1.26 per lineal foot, 20-ft. wide; the cost per lineal foot of the V-shaped drain is only 49c. The Commission has continued its policy of building all culverts and short bridges of reinforced concrete in place of rubble masonry. The largest bridge of this kind built during 1903 was one with a 79-foot span in Williamstown. Several bridges with steel I-beams and concrete arches were also built during the year. It has been found that structures of this kind are cheaper and more durable than those made of masonry. The report is signed by W. E. McClintock, Harold Parker and John H. Manning, Commissioners.

The Friburg-Morat-Anet Electric Railway.*

This road is the first third-rail electric road in Switzerland. It is a high speed interurban line about 25 miles long. The Friburg-Morat section of 16 miles was originally operated by steam and was electrified while in operation. The remainder from Morat to Anet was built when the electric motive power was installed. The results obtained so far appear to justify the hope that the

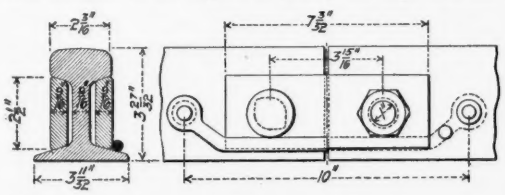


Fig. 1.

use of electricity will increase the traffic and reduce the cost of operation.

The heaviest grade on the line is 2 per cent. and one such grade is 2.3 miles long. The electric energy is obtained from the Friburg-Canton hydraulic central station, which supplies three-phase current at 8,000 volts. This is converted in substations to direct current at 800 volts. The section of the third-rail and the method of splicing and bonding are shown in Fig. 1, while Fig. 2 shows the wooden protectors on the third rail, and the slipper which

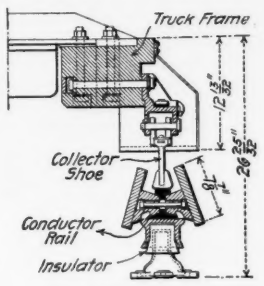


Fig. 2.

picks up the current. The third-rail is laid only on the main line, being replaced at turnouts by an overhead trolley, thus avoiding the complication introduced by third rail switches. It weighs 50 lbs. per yard, and comes in lengths of 66 ft. At intervals of 100 yards, 6-in. spaces are left to allow for expansion. At these points the fish plates are extended up so that they guide the contact shoe over the gaps. At level crossings the third rail is omitted for a distance of 39 ft., which is less than the distance between the extreme collectors of 47 ft. The

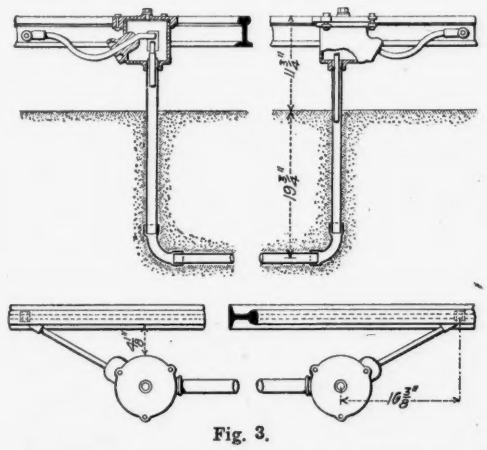


Fig. 3.

ends of the third rail are joined by a conductor carried in an underground pipe, as shown in Fig. 3. The motor cars have eight wheels, and weigh about 72,000 pounds. They carry 8 second class and 40 third class passengers, the latter in three compartments, one smoking compartment with 20 seats and two non-smoking compartments each with 10 seats. A baggage compartment is placed between the second and the third class compartments. The vestibule at each end is divided into two parts, one for the motorman and one to allow passengers to enter the car.

Each motor car has two Oerlikon T. M. 20 motors of from 130 to 150 h.p. Particular attention has been paid to the motor commutators. They are made of 147 strips of hard copper, insulated by sheets of mica 0.03 in. thick, forming a cylinder 16½ in. in diameter with a working length of 7¼ in. In testing the motors, they were given 100 per cent. overload without showing objectionable sparking. The current is taken up from the third rail by four shoes, two in front and two at the back, which make contact by gravity. These shoes are connected rigidly with the axles so that the play of the springs does not alter the relative distance between the rail and the shoe support. In addition to the contact shoes the cars have trolley poles for the portions of the road where the third rail is not installed, the most important of these points being in the stations of Friburg and Morat, which are used jointly with steam roads.

The cars are provided with Westinghouse air brake, a hand brake and an electric brake, which operates by short circuiting the motors through the starting resistances and running them as generators. The motor cars, which themselves carry 48 persons, haul passenger or freight cars up to 70 gross tons weight. A train of this maximum weight will take the 2 per cent. grade at 14 miles an hour while on the level and down grade speeds of respectively 22 and 28 miles per hour are allowed.

There are ten trains each way per day of 18 hours and the schedules are arranged so that each substation has only to supply current to one train at a time. The maximum power required for a train on the heaviest grade is 240 h.p. at the periphery of the wheels. Each of the two substations consists of a 100 k.w. rotary converter which receives 8,000 volt three-phase current and gives out 800-volt direct current. The substations are placed so as to divide the road into three practically equal parts. Each substation has a buffer battery of 400 cells with a capacity of 207 ampere hours. There is no reserve machine, and as each substation can only handle one train at a time, any accident to one of the stations would cut down the number of trains.

*From *Revue Generale des Chemin de Fer.*

The Beginnings of Railroading in Pennsylvania.

(*From notes by* COL. A. K. M'CLURE, *in the Philadelphia Press.*)

The administration of Governor Shunk dated the advent and mastery of the steam railroad in transportation. The question of constructing railroads was earnestly agitated in Pennsylvania some years before the locomotive had been developed, and when the railroad line was expected to be merely a tram road with cars to be drawn by horses.

John Stevens, of New York, a man of broad, progressive ideas, who was abreast with Fulton in the development of the steamboat, was the man who first urged the construction of railroads. His steamboat, the "Phœnix," that ran on the Delaware and Connecticut rivers, was brought to the Delaware by sea, and was the first steamboat to brave the waves of the ocean. As early as 1812 he publicly advocated the theory of carriage by rail, and predicted the practicability of using steam. He appealed to his own State of New York, but was turned down as a pestiferous crank, just as Prof. Morse was when he first went to Congress for aid to construct a telegraph line.

In 1823, after having been repelled in several other States, Mr. Stevens, then at the advanced age of 74 years, made a personal appeal to the Pennsylvania Legislature to construct a railroad from Philadelphia to Columbia. He named such men as Stephen Girard, Horace Binney and John Conley, of Philadelphia, with Amos Ellmaker, of Lancaster, among his incorporators, and Conley was made president of the company. The franchise was given for the period of 50 years, and preliminary surveys were undertaken, but it is evident that the men named as incorporators were not heartily enlisted in the work, as Stevens was never able to raise the sum of $5,000 to complete a mile of the road.

Another charter was granted by the same legislature for the Columbia, Lancaster and Philadelphia Railroad, but no attempt was ever made to vitalize the enterprise.

The necessity for a railroad from Philadelphia to connect with the canal at Columbia became more generally appreciated each year, and as all individual and corporate efforts had failed, the Board of Canal Commissioners ordered a series of preliminary surveys, and the Legislature of 1828 authorized the construction of the road from Philadelphia through Lancaster to Columbia by the State.

It was not a popular measure throughout the Commonwealth, as the great mass of the people believed that the investment of State money in railroads was little less than extravagant waste, and the appropriations were very grudgingly made for the construction of the road, and it was not until April, 1834, that a single track was completed between Philadelphia and Columbia.

THE LOCOMOTIVE'S TEST.

The locomotive had just made its appearance and the first train that passed over the new line from Columbia to Philadelphia on the 16th day of April, 1834, had secured a locomotive known as Black Hawk, then regarded as the finest engine that had been constructed. They did not venture to make the entire trip in one day, but on the 15th the run was made from Columbia to Lancaster, where the party rested overnight. On the morning of the 16th the train left Lancaster at 8 o'clock and arrived at the head of the Schuylkill incline plane at 4.30, making the trip from Lancaster to Philadelphia in eight hours and a half.

So little confidence had the managers in the endurance of the locomotive that an empty horse car followed the locomotive train with relays of horses at different points to rescue the party in case the locomotive gave out. They had much difficulty with the locomotive and at times the passengers had to get out and give a healthy push to aid it in starting.

THE CONESTOGA WAGON OPPOSITION.

It is difficult for our people in this progressive age to understand the desperate resistance made by the people generally throughout the State to the introduction of railroads. When Pennsylvania at an early day had given liberal assistance to the construction of turnpikes, making continuous lines from Baltimore and Philadelphia to Pittsburg, it was accepted that the Commonwealth was in the very front of progress and the turnpikes developed an immense industry in what was known as the Conestoga wagons. Hundreds of six-horse teams, with immense covered wagons, were constantly on the highways, as they transported commerce and trade between the East and West, and they created what formed a very powerful political factor in opposing the introduction of railroads, in the "wagon tavern."

Every few miles along the through turnpikes was found the wagon tavern. There was one or more in every village and well-to-do farmers whose homes were on the turnpikes ran the wagon tavern as a side industry. All of them had very capacious yards about the barn to accommodate the teams during the night. Excepting in extremely inclement weather the horses always stood out securely attached to their wagon. Hay and oats were furnished for the horses at very moderate prices and the driver could obtain a "snack" or cold lunch in the evening, a bed, hot breakfast and an evening and morning drink of whiskey for 25 cents.

The proprietors of the wagon taverns were generally men of influence in the community and when the proposition to construct railroads was seriously urged the wagon drivers and wagon tavern keepers made a most aggressive battle.

Mass meetings were held along the lines of the turnpikes to protest against the introduction of railroads, which were declared to be of doubtful utility and which could be successful only by the destruction of one of the important industrial interests of the State, that had immense sums of money invested and which would certainly be destroyed. Political orators, always ready to cater to popular prejudice, delivered most fervent harangues against the proposed injustice of bringing ruin to the great industrial interests which centered in wagon transportation. In some instances Senators and Representatives were elected solely on that issue.

Fortunately the progress of the railroad was so gradual that there was no violent destruction of the wagon transportation interests and the grand old Conestoga wagon, with its team of six magnificent horses, usually elegantly caparisoned, gradually perished in Pennsylvania.

THE EARLY RAILROAD CHARTERS.

As early as 1829 the public-spirited business men of Baltimore appeared before the Pennsylvania Legislature and asked for a charter for a road from Baltimore to the Susquehanna River, thence to the Borough of Carlisle in the Cumberland Valley. The committee of the Senate reported that it would be against sound public policy to grant the franchise, and the measure failed. The chief reason given for excluding the Baltimore railroad was that the Board of Canal Commissioners had authorized a survey for a road from Harrisburg to Chambersburg and thence by way of Gettysburg to York, and in 1831 an act was passed for the incorporation of the Cumberland Valley Railroad Company.

The progress of the work was very slow, and the franchise was forfeited for want of subscriptions to the stock, but the Legislature extended the time, and on June 2, 1835, sufficient stock had been subscribed to warrant the Government in issuing letters patent creating the company. The bill rechartering the United States Bank as a State institution required the bank to subscribe $100,000 to the capital stock of the company, and Mr. Nicholas Biddle, president of the bank, not only paid the $100,000 subscription, but gave an additional $100,000 to aid the enterprise, but when the bank failed in 1839 the stock of the Cumberland Valley Railroad was hardly worth enumerating among the assets.

"SHINPLASTERS" ISSUED.

The men engaged in the enterprise were confronted time and again with almost insuperable obstacles for want of means, and finally it was completed by a large issue of 50- and 25-cent paper money, then commonly known as "shinplasters." Money was extremely scarce after the financial revulsion of 1837, and the people were willing to receive anything in the similitude of money that had any fair semblance of credit.

When this issue of small bills was made they commanded a reasonable degree of confidence because the directors of the company, most of whom were men of large means for that day, published a statement over their signatures declaring that they individually, jointly and severally guaranteed the payment of these notes. Among the signers was Charles B. Penrose, grandfather of the present United States Senator, Boies Penrose, who was then a State Senator from the Cumberland district.

OPENING OF THE CUMBERLAND VALLEY RAILROAD.

The road was opened with great ceremony from Harrisburg to Carlisle on August 16, 1837; on November 10 the same year it was formally opened to Newville, and on the 16th of the same month the shrill scream of the iron horse was first heard in Chambersburg, where there was a great military and popular display. The road was later extended to Hagerstown, but it was not regularly oper-

ated and only horse trains were run over it. It is now an important link in the Cumberland Valley Railroad's extended line to Winchester.

The interest exhibited by the people of Philadelphia and of Baltimore for the creation of railroad facilities in transportation was quickened by the heroic achievement of New York in the completion of the Erie Canal in 1825. Until that time Philadelphia was the metropolis of finance, commerce and trade, and possessed the largest population of any city in the country, but the completion of the great water highway from Lake Erie to the sea gave an advantage to New York that steadily drained Philadelphia of her money and commerce and the decline of Philadelphia was greatly hastened by Jackson's withdrawal of $8,000,000 of Government deposits from the United States Bank, by the financial crisis of 1837, and by the later failure of the great banking institutions.

Baltimore shared the apprehensions of Philadelphia, and both cities appreciated the necessity of reaching westward to divide the rapidly growing trade of the new States then extending to the Father of Waters, and the State of Missouri on its western shore.

THE BALTIMORE & OHIO.

Strange as it may seem, the Baltimore & Ohio Railroad, then completed from Baltimore to Cumberland, was in advance of the people of Philadelphia in pressing for an all-rail line from the eastern coast to the waters of the Ohio at Pittsburg, and the first bill providing for the incorporation of the Pennsylvania Railroad Company, proposing to construct a line from Harrisburg to Pittsburg, was prepared and presented to the Legislature without the knowledge of the Philadelphia business men. The Baltimore & Ohio had obtained from the Pennsylvania Legislature in 1845 a franchise for the extension of its road from Cumberland to Pittsburg. As there was then no proposition to construct any other railroad line in the State, little opposition was exhibited to the project of the Baltimore & Ohio.

THE PENNSYLVANIA RAILROAD.

The man who first conceived and prepared the bill for the incorporation of the Pennsylvania Railroad Company was Captain Samuel D. Karns. He was jolly and companionable, and one of the most popular of the captains of the packet boats on the canal during the summer season, and in the winter he made his home at Harrisburg, and paid the expenses of what would now be regarded as rather a frugal livelihood, by picking up small fees as a lobbyist. He did not pretend to debauch legislators, but gave such attention to little matters of personal legislation as made parties willing to pay him the small fee he demanded.

He was very popular with most of the men in the Legislature, and could readily accomplish little special legislation that was unobjectionable. He saw the proposition of the Baltimore & Ohio for an extension of its lines through Pennsylvania to Pittsburg, and he concluded that there should be competition, chiefly for the purpose of enlarging his income by an arrangement with the Baltimore & Ohio. He prepared a bill for the incorporation of the Pennsylvania Railroad Company, but failed to enlist any general interest in it, and it made no figure in halting the Baltimore & Ohio, but it finally awakened the people of Philadelphia to the importance of Philadelphia having a central line through the State to Pittsburg. The franchise asked for by the Baltimore & Ohio was granted, but with severe conditions, and the franchise was forfeited within a year by failure to comply with its requirements.

When the Legislature of 1846 met Philadelphia had become thoroughly aroused to the importance of having a through railroad line, and the only through line in the State, from the Atlantic Coast to Pittsburg, and the charter of the Pennsylvania Railroad Company was ready when the Legislature opened, and a large and powerful lobby of Philadelphia business men was on hand to press its passage.

P. R. R. VS. B. & O.

The Baltimore & Ohio was there also with influential backing to obtain a renewal of the franchise it had forfeited. These two great interests were face to face and locked horns for a desperate conflict. The struggle lasted through nearly the entire session, and the debates in both branches became extremely bitter. The Baltimore & Ohio was logically backed by all the southern counties of the State on the line of its road.

Both sides believed that it would be midsummer madness to attempt to make two roads through the State, and that the successful party in the battle would have the only railroad line through the State for all time. So desperate was the conflict, with both sides lacking absolute confidence of success, that it finally ended in the passage of both bills, but with such limitations on the Baltimore & Ohio charter that it was within the power of the Pennsylvania corporation by advancing rapidly in its work, to render null and void the franchise to its competitor. The bill for the charter of the Pennsylvania Railroad Company was approved on April 13, 1846, and on April 21, 1846, being the day before the final adjournment, the Baltimore & Ohio bill was approved.

The Baltimore & Ohio bill provided that if the Pennsylvania Company should have $3,000,000 of bona fide subscriptions to its stock and 10 per cent. paid in, it would secure letters patent from the Governor, and if 30 miles or more be put under contract for construction to the satisfaction of the Governor, and $1,000,000 of stock subscription in its treasury on or before July 30, 1847, the Governor should issue his proclamation declaring that the right of way of the Baltimore & Ohio through Pennsylvania should be null and void.

The business people of Philadelphia appreciated their opportunity and the sentiment was so strong in favor of the new enterprise that the city authorities made a liberal subscription, which, with the action of a number of stockholders paying their instalments in advance, gave the company the required money in the treasury, and on August 2, 1847, the Governor issued his proclamation declaring the franchise of the Baltimore & Ohio to be null and void.

TECHNICAL.

Manufacturing and Business.

The Oro Machine Company, of Richmond, Va., was recently incorporated with a capital of $500,000. Ware B. Gay is President.

The Independent Railroad Supply Company, Chicago, has recently received an order for several miles of Wolhaupter joints from the Minneapolis, St. Paul & Sault Ste. Marie.

The Snyder Automatic Railway Signal Co., of Abingdon, has been incorporated in Illinois with a capital of $20,000, to make railroad devices. The incorporators are D. M. Snyder, F. S. Marshall and E. J. King.

The Montgomery Car Equipment Company has been incorporated at Ottawa, Canada, to make and sell railroad supplies in Toronto. The incorporators are F. C. Annesley, A. J. Mitchell and others, of Toronto, and John Montgomery, of Simcoe.

Milliken Bros. have the contract for building the power house for the Eastern section of the Pennsylvania, New York & Long Island R. R. in Long Island City, which will require about 25 tons of structural steel.

William L. Saunders, who has been Vice-President of the Ingersoll-Sergeant Drill Co. since 1897, has succeeded the late William R. Grace as President of that company. George R. Elder has been elected 3d Vice-President.

The Pittsburg Coal Car Co., of Jersey City, has been incorporated in New Jersey with a capital of $100,000, to make railroad cars, by T. L. Robbins and W. K. Woodford, Pittsburg, Pa., and M. H. Taylor, Erie, Pa.

The Dealers' Steam Packing Co., of Palmyra, N. Y., has been incorporated with a capital of $25,000 to make packing for steam, air and water pipes, etc. The incorporators are James P. Ballon, S. N. Sawyer and others.

The Farlow Draft Gear Co., of Baltimore, Md., has been incorporated in Delaware with a capital of $250,000 to make draft gears. J. Edward Harvey, Dwight F. Malroy and John H. Farlow, all of Baltimore, are incorporators.

The Pennsylvania Engineering Co., Pittsburg Pa., has been incorporated in Delaware with a capital of $25,000 to build bridges, wharves, etc., by George R. Delamater, James J. Connelley and Louisa A. Harding, all of Pittsburg, Pa.

The Wheland Machine Works, of Chattanooga, Tenn., has awarded a contract to the Converse Bridge Co., of that city, to build a steel and brick foundry 40 ft. high, 110 ft. wide and 200 ft. long, to cost about $25,000. Work will begin at once.

The Damascus Process Company has been incorporated in New Jersey with a capital stock of $1,000,000 to make iron and steel. The incorporators are George F. Wheeler and John W. Cavanaugh, of New York, and Owen F. Conlin, of Newark, N. J.

The Barberie Locomotive Appliance Co., of Brooklyn, has been incorporated in New York with a capital of $100,000 to make automatic signaling apparatus for use on locomotives. The incorporators are John Barberie and Mercie Dunn, of Brooklyn, and others.

The American Dressed Beef & Provision Car Line Co. has been incorporated in New Jersey with a capital stock of $200,000, to make refrigerator and other cars, by Robert N. Clyde, Frank L. Palmer and Charles O. Geyer, all of 525 Main street, East Orange, N. J.

The Mexican Car & Foundry Co., organized in Mexico City, Mex., with a capital of $1,000,000, which owns 71 acres of land three miles from the city, has started work on its new shops. Isaac M. Hutchinson has been elected President and Pablo Martinez Del Rio, Vice-President.

The Ajax Manufacturing Co., Cleveland, O., through their New York office, has sold to the Grand Trunk Railway, one of their large heading, forging and upsetting machines, a large bulldozer, also a hot-pressed nut machine. They will be installed in the Montreal shops.

Bids are wanted, April 30, by the Bureau of Yards and Docks, Navy Department, Washington, D. C., for improving and building a 100-ton steel shears at the Navy Yard, Boston, Mass., for which the sum of $19,500 is available. Mordecai T. Endicott is Chief of the Bureau.

The Train Order Protector & Signal Lock Co., of Nashville, has been incorporated in Tennessee with a capital stock of $100,000 to make machines for the protection of train orders and signal locks under a patent of E. H. Roy. The incorporators are F. E. Draper, E. H. Roy and others.

At the adjourned annual meeting of the Chicago Pneumatic Tool Co., held April 2, the retiring Board of Directors was re-elected. The three directors of the company whose terms were about to expire were re-elected. They are J. R. McGinley, Pittsburg; Joseph Boyer, Detroit, Mich.; Archibald W. Manconachie.

The Scott & Oliver Manufacturing Company, of Knoxville, Tenn., has plans ready for building a large machine shop. A contract has been let to the American Bridge Co., of Pennsylvania, for a 400-ft. steel structure. The long building formerly used by the Southern Car Co. will be utilized by the company; also a large warehouse to be built by the Scott Car Co. Works.

The Railroad Track Equipment Co. has been formed by John M. Garland, President of the Industrial National Bank, Pittsburg; Wm. M. Hall, Jr., of Hall & Adair, Pittsburg; W. C. Magee, President of the Pickards & Magee Coke Co., Pittsburg, and G. L. Hall, of the G. L. H. Rail Joint Co., New York City. Application for a charter under the laws of Pennsylvania has been made with the object of establishing a plant at West Pittsburg, Pa., to make rail joints and other railroad specialties and to take over the business of the G. L. H. Rail Joint Co. The company will devote its energies to making and selling insulated joints and other articles patented by George L. Hall.

The British Westinghouse Electric & Manufacturing Co. is said to have secured the contract, in competition with British and German firms, for supplying the generating equipment to be put in by the municipalities of Kalk and Muizenberg, Cape Colony, South Africa, for electric lighting purposes, which will cost in the neighborhood of about $200,000. The company is also reported to have received an additional contract from the Metropolitan Railway, of Paris, to equip 91 of its cars with multiple unit control on the Miallot-Vincennes lines, each train to consist of three motor cars and four other cars. The contract includes the supply of nine double motor equipments of 200 h. p. capacity each.

The American Locomotive & Machine Co., of Canada, controlled by the American Locomotive Company, which recently bought the Locomotive & Machine Co., of Montreal, at Longue Point, has just held its first meeting. The directors of the Canadian company (all Canadians but one) are as follows: President, S. R. Callaway, New York; Chairman, K. W. Blackwell, President and Managing Director of the Montreal Steel Co. and Vice-President of the Montreal Street Railway; J. Reid Wilson, Vice-President and Managing Director of Thomas, Robertson & Co., Ltd.; M. G. Haney, President of the old company, and Robert Miller, General Manager of the company. Mr. Miller expects shortly to retire from the Board.

Iron and Steel.

The Muskingum Valley Sheet Steel Company, of Zanesville, Ohio, announces that a fourth mill will be added to its works.

It is reported from Birmingham, Ala., that more iron was sold during March in the Southern district than in any month for the past year, and that the production for the next two months or more has been sold. The furnaces recently put in operation at Ensley, in addition to the one at Thomas, will add about 400 tons a day to the production of the district.

The annual report of the Nova Scotia Steel & Coal Co. for the year ending Dec. 31 shows profits for the year of $859,397, which, added to the previous balance of $453,199, makes a total surplus of $1,312,596. The quantity of iron ore sold last year shows a decrease, but the coal output was largely increased. Work on the new plant at the Sydney mines will be rapidly pushed when summer opens.

Four-Cylinder Balanced Compound for the Pennsylvania.

The de-Glehn four-cylinder balanced compound which has been bought by the Pennsylvania and which will be tested at St. Louis is practically the same as those used by the Paris & Orleans. Only minor changes have been made, such as the pilot, safety valve, etc. The tender is fitted with a water scoop. The general dimensions are as follows:

Driving wheels, 4	6 ft. 8 3/16 in.
Length of engine	42 ft. 8⅝ in.
Length of tender	28 ft. 3¼ in.
Length over all	70 ft. 11⅞ in.
Weight on driving wheels	83,600 lbs.
Cylinders, high-pressure, 2	14 3/16 x 25 3/16 in.
Cylinders, low-pressure, 2	23⅝ x 25 3/16 in.
Boiler, straight top, diameter	4 ft. 11½ in.
Working steam pressure	227½ lbs.
Heating surface, total	2,616.8 sq. ft.
Grate area	33.9 sq. ft.

Cost of Electrifying the Railroad System of England.

The English Institution of Electrical Engineers devoted a recent meeting to a discussion of a general electrification of the railroads of England. A paper was read by Mr. F. F. Bennett, estimating the cost of equipping the entire railroad system with electricity by means of power houses located every 50 miles and serving alike all railroads within the radius, regardless of their corporate identity. The necessary community of interest was to be obtained through a central board of railroad managers, organized on lines similar to the railroad clearing house which has worked successfully and harmoniously for a number of years. Mr. Bennett made the rather ambitious estimate of 150 million pounds as the cost of electrification, and figured that another 150 million pounds would be required for increased facilities to provide for the greatly enlarged traffic which was to result. He calculated the cost of working, after making the changes, at 51.6 per cent. of gross receipts, instead of 64 per cent., as in the 1901 railroad returns on which his estimates were based. It is to be feared that there is a chance of error in calculations involving £300,000,000, and that conservative British managers may be a little cautious in following out Mr. Bennett's plan.

THE SCRAP HEAP.

Notes.

The steamer "Plymouth," of the New York, New Haven & Hartford Railroad, running between New York and Fall River, is to be equipped with wireless telegraph apparatus.

The Oregon Railroad & Navigation Company has issued an order requiring all employees connected with the movement of trains to submit to a physical examination for hearing, eyesight, etc., before May 15.

It is announced that henceforth the Pullman Company will operate all of the parlor cars on the lines of the Pennsylvania road. Hitherto some of the cars, particularly on the Atlantic City line, have been owned and operated by the railroad company.

On the night of March 31 the southbound Oregon express of the Southern Pacific was stopped by robbers near Copley, Cal., and the express messenger was shot and killed. The express car was blown up with dynamite. The robbers took the contents of the money box, the value of which is not stated.

The Baltimore & Ohio has made an agreement with a committee of the telegraph operators of the company by which there will be a large number of increases in wages. It is said that the increases will aggregate $30,000 a year. An increase amounting to $70,000 yearly was made about one year ago.

The Railroad Commission of Florida, after a conference with the railroads and a large number of lumber shippers, has issued a rule (No. 23) requiring that platform cars furnished to shippers be provided with "equipment capable of being readily removed or lowered, so that the lumber or timber may be readily lowered on or off of the said car without being obstructed or inconvenienced by such equipment."

Chicago papers say that all of the roads from Omaha to that city are running freight trains with dressed meat from Omaha to Chicago in 24 hours, notwithstanding the recent agreement through the general managers' association to run no freight trains between the two cities in less than 30 hours. The Rock Island is said to have begun the strife, by making an agreement with the packers, and getting an increased share of the dressed beef traffic.

Texas papers report that the railroads in that State are complying, or preparing to comply, with the order recently issued by the State health officer concerning the sanitation of passenger cars. Cuspidors are to be provided for every two double seats in each passenger car, and they must be washed every 24 hours. On the Santa Fe the disinfectant to be used is bichloride of mercury solution of 1 to 1,000, and 6 oz. of this solution will be put into each cuspidor each day.

Two conductors of the New York City Railway Company (late the Metropolitan) were convicted of petit larceny in Manhattan last Tuesday for appropriating money which had been collected for fares. At the trial the deputy assistant district attorney, who appeared for the prosecution, said that the New York City Railway Company is forced to discharge about 200 men a month for such stealing as this; and that the company intended hereafter to punish every offender caught.

The Land & Immigration Department of the Southern Pacific, in Texas, reports that during the past year 1,046,456 acres of land were sold in that State and Louisiana, and 5,002 home seekers were brought there, through the instrumentality of the immigration agents of the railroad, who are scattered throughout the northern and eastern parts of the country. The amount of money expended for the advertising, which has brought this return, is stated at $40,000. The report gives statistics of the increase in the rice industry and in other lines of business in the territory adjacent to the railroad.

The State weighmaster of Minnesota, who has charge of the administration of the law regulating the grain business at elevators, says, in his annual report, that his department has ceased to be self-sustaining because, in consequence of the rapid increase of large cars and the almost complete abolition of small cars, the fees received for weighing grain—which are based on the number of cars—have fallen off seriously. For the year just closed the employees of the department have weighed 4,914 less cars than in the previous year, while the quantity of grain has increased 13,000,000 bushels. The rapidity with which small-capacity cars have been worn out or destroyed is indicated by the fact that in 1901 the weighmaster's department had a surplus of $5,817, while in the year just closed there was a deficiency of $11,129.

Fires.

The Citizens' Electric Street railroad barns, in Newburyport, Mass., were destroyed by fire March 28, together with 25 cars; loss, $60,000. The Pittsburg Valve & Foundry Co.'s works, Pittsburg, was destroyed by fire March 29 at a loss of between $350,000 and $500,000. The New York Central coaling station at Rensselaer, N. Y., built about a year ago at a cost of $60,000, was destroyed by fire April 1.

Atlanta Ticket-Brokerage Law.

The city of Atlanta, Ga., has adopted an ordinance to license ticket brokers, which regulates ticket brokerage very rigidly. A full copy of the ordinance is printed in the *Official Guide* for April. A broker must pay $300 a year license; this is for one location, which must be described by street and number. He must make a daily report to the chief of police of all tickets bought and sold, with full particulars, including number of ticket and name of buyer and seller. The office must be at all times open to inspection by any city police or detective officer. Failure to report a ticket subjects the broker and all his clerks to $500 fine, or 30 days' imprisonment, or both, and the conviction means revocation of the license. A bond of $2,000 must be given. It is made unlawful to deal in passes or in mileage, excursion, or commutation tickets, and in all non-transferable tickets. There are other provisions equally severe.

Commenting on this ordinance the *Official Guide* says: "This law does not interfere with the handling of any ticket which by the utmost stretch of the English language could be fairly called transferable. It only prohibits the sale of tickets which demand false impersonation or forgery by the persons attempting to use them. If a broker desires only to do an upright and honest business there is nothing in the law to prevent it. We understand that they have all, however, put up their shutters in disgust."

Discussing brokerage further, the Editor says: "The troubles of the scalpers multiply. Their appeal from the decision in the St. Louis cases has been decided against them, and in various parts of the country members of the fraternity are coming into more or less violent collision with the courts upon questions of forgery and other little practices not generally approved in good society. The scalper is a sort of vermiform appendix of the passenger business. Students of anatomy say that it is possible that the vermiform appendix in an ape may perform a useful function, but as man has progressed in evolution its usefulness has disappeared, and it remains only a source of danger and annoyance. In the monkey stage of the passenger traffic a scalper may possibly have had his uses, but at the present day he is nothing more than a sore spot. The sooner he is removed, the better for all concerned."

Causes of Accidents to Persons.

In a lecture at Yale University, Mr. S. C. Dunham, President of the Travelers' Insurance Company, gave the following list of percentages of causes of injuries on which claims are made for compensation from this company (the cost of the different kinds of accident, which would give some idea of the relative seriousness of cases in the different classes, is not given):

	Per cent.
Accidents to pedestrians	24.14
At home (indoors)	18.80
Horses and vehicles	18.16
At home (outside)	15.98
Recreation	6.15
Railroad travel	4.77
Bicycle accidents	4.06
Street car travel	2.74
Use of firearms	1.73
Animal bites	1.52
Assaults	1.20
Steamship travel	.70
Miscellaneous	.05
	100.00

MEETINGS AND ANNOUNCEMENTS.

(For dates of conventions and regular meetings of railroad associations and engineering societies see advertising page 16.)

Freight Claim Association.

The annual meeting of this association will be held in Savannah, Ga., on May 18.

The American Railway Association.

The spring session of this association will be held at the Waldorf-Astoria, New York City, on April 27. Reports will be presented by the committees on Train Rules, on Car Service, on Safety Appliances, on Statistical Inquiry, and on the Standard Cipher Code. The annual election of officers will take place at this meeting.

American Institute of Electrical Engineers.

The next meeting of this association will be held in New York City on the evening of April 22, at which the subject for discussion will be "Alternating-Current Generators." Papers will be read on "Mechanical Construction of Revolving Field Alternators," by David B. Rushmore; also "Contributions to Theory of the Regulation of Alternators," by H. M. Hobart.

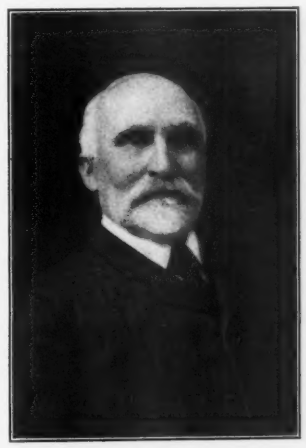
Air-Brake Association.

The eleventh annual convention of this association will be held at Buffalo May 10, 11 and 12. Papers will be read on "Electric Car and Train Brakes," "Higher Train Pressure for Passenger Train Service, and Conditions to Use It," "The Practice of Bushing Air-Pumps," "Backing Passenger Trains with Tail Hose," "Standard Length of Brake-Beam, Suspension of Same and Foundation Brake."

PERSONAL.

—Mr. S. J. Haydon, formerly Auditor of the Choctaw, Oklahoma & Gulf, and before that for some years in the accounting department of the Louisville & Nashville, but lately a resident of New York City, committed suicide in New York on the afternoon of April 1, by jumping from a window 320 feet above the pavement to the street below.

—Colonel Frank J. Hecker, of Detroit, who has been appointed a member of the Isthmian Canal Commission, is about 58 years old. He was born near Ann Arbor, Mich., but his early life was spent in St. Louis. During the war of the Rebellion he was a sergeant under General Dodge. After the war Col. Hecker was on the Union Pacific. This was during the construction period and he was at one time Agent at Cheyenne, and for a short time Acting Assistant Superintendent. In 1870 he came east and took charge of the Rondout & Oswego Railroad, and two years later he was made Manager of the Walkill Valley, now a part of the West Shore. From here he went successively to the construction department of the Rhinebeck & Connecticut, and to the management of the Detroit, Eel River & Illinois. In 1879, with Messrs. Alger, Joy and others, Col. Hecker organized the Peninsular Car Company, which afterwards was consolidated with the Michigan Car Company. He was for several years President of this company. Col. Hecker is of commanding appearance and has earned high place as an able executive officer.



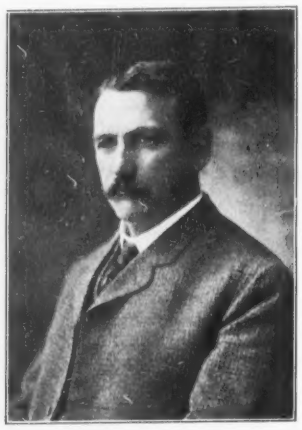
—Mr. Benjamin La Fon Winchell, who has just been chosen to succeed Mr. Leeds as President of the Chicago, Rock Island & Pacific Railway, has for some time past been First Vice-President of the St. Louis & San Francisco, and since January last Third Vice-President of the Rock Island in charge of traffic. Mr. Winchell is a native of Missouri, having been born in Palmyra in 1858, and he has been in railroad service nearly 32 years. He began in the Hannibal shops of the Burlington in 1874, but was later transferred to the Auditor's office. In 1877 he took a position in the freight department of the Atchison & Nebraska, but soon resigned to go to the Kansas City, Fort Scott & Gulf. In June, 1882, he became Assistant General Passenger Agent of the Kansas City, Fort Scott & Memphis, and in 1895 went to the Union Pacific, where he was General Passenger Agent. Later Mr. Winchell took the General Passenger Agency of the St. Louis & San Francisco, and in 1898 was elected Vice-President and Traffic Manager of the Colorado & Southern. In October, 1900, he was chosen President and General Manager of the Kansas City, Fort Scott & Memphis, and in September, 1901, was made Vice-President and General Manager of the "Frisco" system.

—Mr. Thornwell Fay, the new General Manager of the Southern Pacific lines in Louisiana and Texas (Morgan's Louisiana & Texas; Texas & New Orleans; Galveston, Harrisburg & San Antonio; Houston & Texas Central), will assume the duties of Vice-President of the Galveston, Harrisburg & San Antonio, heretofore discharged by Mr. Markham. Mr. Fay was born 43 years ago at Minden, La., and at the early age of 14 was an operator at Brandon, Miss. He afterward worked for the Illinois Central at New Orleans, but resigned his place on that road to go to Morgan's Louisiana & Texas. For four years (1880-1884) he was station agent, and the year following, 1884, was private secretary to the President. In 1885 he was made Secretary to the General Manager of the Atlantic System of the Southern Pacific and was successively chief clerk to General Manager and Manager's Assistant. In January, 1902, Mr. Fay was elected Vice-President and General Superintendent of Morgan's Louisiana & Texas Railroad and Steamship Company and General Superin-

tendent of the Louisiana Western, which position he has held up to the time of his present appointment.

—Mr. A. J. Davidson, who on Tuesday of this week became the President of the St. Louis & San Francisco, and will make his headquarters in St. Louis, has for three years been the General Superintendent of the system. He began his railroad work in 1880 as a station baggage agent for the Chicago & Alton at Lexington, Ill. Four years later he went to Texas as an operator for the St. Louis Southwestern, and subsequently became chief clerk to the Superintendent of that road and later, train despatcher. In 1888 he was appointed Chief Train Despatcher for the San Antonio and Aransas Pass, and later was made Trainmaster. In 1893 he went to the Gulf, Colorado & Santa Fe as Division Superintendent at Fort Worth and upon the reorganization of the "Frisco" in 1898 went to St. Louis as Superintendent of Transportation. Three years afterwards (1901) he was promoted to be General Superintendent of the entire system, with office at Springfield, Mo.

—Mr. John F. Stevens, the new Second Vice-President of the Rock Island, has, since August last, been Fourth Vice-President of this company. Mr. Stevens was born at West Gardiner, Me., 51 years ago, and began his railroad career as Chief Engineer of the Sabine Pass & Northwestern Railway in 1876. For about 14 years following the latter date Mr. Stevens was Assistant Engineer on the Sabine Pass & Northwestern, the Denver & Rio Grande, the Chicago, Milwaukee & St. Paul, the Canadian Pacific, the Duluth, South Shore & Atlantic and the Spokane Falls & Northern. In 1890 he went to the Great Northern, where he became Principal Assistant Engineer, and five years afterward was promoted to be Chief Engineer of the company. In March, 1903, Mr. Stevens was appointed Chief Engineer of the Chicago, Rock Island & Pacific and a few months later was elected Fourth Vice-President, from which position he is now promoted to succeed Mr. Mather (First Vice-President), as Second Vice-President. Mr. Stevens' office will remain in Chicago. Mr. Stevens, while on the Great Northern, had charge of many important pieces of work. While principal Assistant Engineer he located and built the line over the Cascade Mountains, and laid out the famous "Switchback." While Chief Engineer he entirely rebuilt important sections of the road in Dakota, in Montana and in eastern Washington. He also built the Cascade tunnel, two and one-half miles long.



—The accompanying portrait is that of Mr. Charles H. Markham, the new General Manager of the Pacific System of the Southern Pacific. As stated in our notice printed March 25, Mr. Markham has been in the service of the Southern Pacific for 23 years. He was born in Tennessee in 1861. He began as a section laborer on the Atchison, but soon secured a place as station agent on the Southern Pacific and his career has been somewhat unusual in the fact that he was a station agent in what most of us call the "wild west" (at different places in New Mexico, Arizona and Nevada) for a dozen years, and was in that work altogether 16 years, before he became an officer; though during the latter part of this 16 years while he was agent at Fresno he was district freight and passenger agent. While here the attention of the managing officers was attracted by Mr. Markham's energy and zeal in helping to bring about remarkable improvements in handling the traffic originating in that district. They were seeking to secure better car and train loading and it was extremely difficult to get the shippers to consent to load cars, or to permit them to be loaded, to anything like their full capacity. Through exercise of diplomacy, tact, and, perhaps more than all, hard common sense, Mr. Markham in a few months brought the shippers around to the railroad company's point of view. This record led to his appointment as General Freight and Passenger Agent of the company's Oregon lines, and during the four years that he occupied that position he handled the company's interest with signal ability. Then for a short time he was Assistant Freight Traffic Manager at San Francisco, but the company soon needed a general officer in Texas; Mr. Markham was considered just the man for the position and in the latter part of 1901 he was made Vice-President and General Manager of the Houston & Texas Central, the Galveston, Harrisburg & San Antonio and the Texas & New Orleans, in fact, all of the lines in Texas and Louisiana formerly known as the Atlantic System of the Southern Pacific. In his management of these roads his greatest achievement was in the line of educating public opinion in Texas and bringing its regulating force to bear on oppressive verdicts rendered by juries in personal damage suits. The situation seemed absolutely hopeless, yet within less than a year a very marked change was wrought, and within the last two or three months Texas juries have actually rendered verdicts in favor of the defendant. Judges have taken official cognizance of the iniquitous doings of what are known in Texas as the "railroad damage-suit lawyers," and have instructed grand juries to investigate their dishonest and nefarious practices. In this direction Mr. Markham rendered the interests of his company and the interest of all corporations in Texas a most signal and valuable service.

ELECTIONS AND APPOINTMENTS.

Boston & Maine.—C. C. Battey, of Springfield, Mass., has been appointed Supervisor of Bridges and Buildings, with headquarters at Concord, N. H., succeeding S. Harriman, resigned.

Chicago & Alton.—G. L. Moore, Engineer of Maintenance of Way, with office at Bloomington, Ill., has resigned and that position has been abolished. It is said that Mr. Moore will take a similar position on the Rutland.

Chicago Great Western.—E. C. Macy has been appointed Principal Assistant Engineer.

The position of Bridge Engineer, formerly held by A. Munster, has been abolished.

Chicago, Rock Island & Pacific.—B. L. Winchell has been elected President of the Chicago, Rock Island & Pacific *Railway* of Iowa. Robert Mather, hitherto Second Vice-President and General Counsel, has been chosen to succeed C. H. Warren as First Vice-President. Mr. Warren has resigned. J. F. Stevens, now Fourth Vice-President, has been elected Second Vice-President, succeeding Mr. Mather. These changes affect only the *Railway* or operating company. L. F. Loree is President of the Rock Island Company of New Jersey, which holds the securities of the C., R. I. & P. *Railroad*. The *Railroad* owns the C., R. I. & P. *Railway* and also the St. Louis & San Francisco.

See Terminal Railroad Association of St. Louis.

Colorado & Southern.—H. Van Mater, Assistant to the President and Assistant Secretary and Treasurer, with office at Denver, Colo., has resigned.

El Paso-Northeastern.—H. L. McLow has been appointed Assistant Superintendent of Motive Power and Machinery, with headquarters at Alamogordo, N. Mex.

Erie.—George W. Wildin has been appointed Mechanical Superintendent, in place of W. S. Morris, resigned. Mr. Wildin has been Assistant Mechanical Superintendent since last February, and his portrait was published on the 26th of that month.

J. Burke, Engineer of Maintenance of Way (C. & E.) at Cleveland, Ohio, has been transferred to New York, where he will have charge of maintenance of way on the lines east of Salamanca. R. S. Parsons has been appointed to succeed Mr. Burke at Cleveland.

Great Northern.—J. H. O'Neill, hitherto Superintendent at Havre, Mont., has been appointed Superintendent at Kalispell, Mont., succeeding A. E. Long, resigned. C. O. Jenks, Assistant Division Superintendent at Superior, Wis., has been appointed to succeed Mr. O'Neill at Havre.

Missouri Pacific.—J. M. Sommers has been appointed Superintendent, with headquarters at Nevada, Mo.

National of Mexico.—The duties formerly discharged by H. M. Taylor, Superintendent of Construction, will hereafter be attended to by James M. Reid, Chief Engineer of Construction.

Oregon Short Line.—E. Buckingham, hitherto Superintendent of Transportation of the Union Pacific, has been appointed General Superintendent of the O. S. L., with headquarters at Salt Lake City. The position of Assistant General Manager, formerly held by E. E. Calvin, has been abolished.

St. Louis & San Francisco.—B. F. Yoakum has been elected Chairman of the Board and A. J. Davidson, hitherto General Superintendent of the company, has been chosen to succeed Mr. Yoakum as President. Mr. Yoakum will have his office at New York City and Mr. Davidson at St. Louis. (See also Chicago, Rock Island & Pacific.)

George H. Brown has been appointed Master Mechanic, with headquarters at Fort Smith, Ark., succeeding Thos. Paxton.

Southern.—W. H. Hudson, hitherto Master Mechanic at Atlanta, Ga., has been promoted to be General Master Mechanic of the Western District, with headquarters at Birmingham, Ala.

Southern Indiana.—C. F. Weinland has been elected Treasurer of this company and the Illinois Southern, succeeding L. A. Walton, resigned. A. F. Williams has been appointed Auditor of both companies.

Southern Pacific.—J. H. Worthington has been appointed Assistant to J. Kruttschnitt, Director of Maintenance and Operation. Mr. Worthington's office will be at Chicago.

Susquehanna & New York.—P. M. Newman, hitherto Freight Agent and Assistant to the General Manager of the Williamsport & North Branch, has been appointed General Manager of the S. & N. Y.

Terminal Railroad Association of St. Louis.—W. Miller has been appointed Master Mechanic, succeeding T. N. Gilmore, who has resigned to take a similar position on the Chicago, Rock Island & Pacific.

Toledo, St. Louis & Western.—R. Williams has been appointed General Superintendent, with headquarters at Toledo, Ohio, succeeding J. L. Frazier, resigned.

Union Pacific.—J. M. Gruber, formerly on the Rock Island, has been appointed Superintendent of Transportation, with headquarters at Omaha, Neb., succeeding Mr. Buckingham, resigned. (See Oregon Short Line.)

Williamsport & North Branch.—See Susquehanna & New York.

LOCOMOTIVE BUILDING.

The Canadian Pacific is reported to have ordered 11 locomotives from the Canadian Locomotive Co., Kingston, Ont.

The Kohala & Hilo is in the market for three locomotives and a small amount of rolling stock of 80,000 lbs. capacity. Robert Hawxhurst, Jr., Hilo, Hawaiian Islands, is Chief Engineer.

The Canadian Pacific is reported to have ordered 10 locomotives from the Locomotive & Machine Co., of Montreal, Ltd., which was recently purchased by the American Locomotive Co.

The Atchison, Topeka & Santa Fe is building 12 simple six-wheel switching (0-6-0) locomotives at its Topeka shops. These locomotives will weigh 140,000 lbs.; cylinders, 20 in. x 26 in.; diameter of drivers, 51 in.; extended wagon-top boilers, with a working steam pressure of 180 lbs.; heating surface, 1,928 sq. ft.; 281 iron tubes, 2 in. in diameter and 12 ft. long; steel fire-box, 102⅛ in long and 41¼ in. wide; grate area, 29.25 sq. ft.; tank capacity, 3,900 gallons of water, and coal capacity, eight tons. The special equipment includes: American Brake Co.'s air-brakes, Cambria steel axles, Franklin Magnesia boiler lagging, Monarch brake-beams, A., T. & S. F. standard brake-shoes, headlights, and journal bearings; Tower couplers, Ohio injectors, U. S. piston and valve-rod packings, Crosby safety valves, Leach pneumatic sanding devices, Chicago triple sight-feed lubricators, American Steam Gage & Valve Mfg. Co.'s steam gages and cast-iron tender wheels and wheel centers.

The Southern, as reported in our issue of March 18, is having 10 Simple Pacific (4-6-2) locomotives built at the Richmond Works of the American Locomotive Co. These locomotives will weigh 219,690 lbs., with 143,000 lbs. on drivers; cylinders, 22 in. x 28 in.; diameter of drivers, 72 in.; wide fire-box, with a working steam pressure of 220 lbs.; heating surface, approximately, 4,065 sq. ft.; 322 tubes 2¼ in. in diameter and 20 ft. long; fire-box, 108 in. long x 72 in. wide; grate area, 54 sq. ft.; tank capacity 6,000 gallons of water, and coal capacity 12½ tons. The special equipment includes: Westinghouse high-speed air-brakes, open-hearth axles, Gollmar bell-ringer, Magnesia boiler lagging, diamond special brake-beams, cast-iron brake-shoes, Tower couplers, Pyle-Electric headlights, Hancock injectors, Ajax journal bearings, United States metallic piston rod and valve rod packings, Coale safety valves, Leach sanding devices, Nathan sight-feed lubricators, Railway Steel-Spring Co.'s springs, Ashcroft steam gages, Gold steam heating equipment and cast-steel wheel centers.

The Boston & Maine, as reported in our issue of April 1, has ordered 10 Simplex mogul (2-6-0) locomotives and 10 Simplex 6-wheel (0-6-0) switching locomotives from the American Locomotive Co. The (2-6-0) locomotives will weigh 142,060 lbs., with 122,800 lbs. on drivers; cylinders, 19 in. x 26 in.; diameter of drivers, 65 in.; extended wagon-top boiler with a working steam pressure of 200 lbs.; heating surface, 1,846 sq. ft.; 286 National Tube Co.'s tubes, 2 in. in diameter and 11 ft. 8 in. long; fire-box, 108 3/16 in. long and 40⅜ in. wide, inside measurement; grate area, 30.2 sq. ft.; tank capacity, 4,000 gallons of water and coal capacity 7 tons. The (0-6-0) locomotives will weigh 114,000 lbs., with cylinders 19 in. x 24 in.; diameter of drivers, 50 in.; straight-top, radial-stay boiler with a working steam pressure of 160 lbs.; heating surface, 1,635.7 sq. ft.; 259 National Tube Co.'s tubes, 2 in. in diameter and 11 ft. long; fire-box, 102 in. long and 33 in. wide, inside measurement; grate area, 23.5 sq. ft.; tank capacity 4,000 gallons of water, and coal capacity 7 tons. The special equipment for both includes: Westinghouse-American brakes, Carnegie axles, Sterlingworth brake-beams, American Brake Shoe & Fdry. Co.'s brake-shoes, Tower couplers, Dewey headlights, Hancock injectors, United States metallic piston rod and valve rod packings, Ashton safety valves, Leach sanding devices, Nathan sight-feed lubricators, Fox trucks, Westinghouse draft gear and American Locomotive Co.'s springs.

The Wabash has ordered 37 compound mogul (2-6-0) locomotives, 10 simple Atlantic (4-4-2) locomotives, 10 simple 10-wheel (4-6-0) locomotives and 10 simple six wheel switching (0-6-0) locomotives from the Baldwin Locomotive Works, for May and June delivery. The mogul locomotives will weigh 150,000 lbs., with 129,000 lbs. on the drivers; cylinders, 20½ and 32½ x 28 in.; diameter of drivers, 63 in.; radial stayed extended wagon-top boilers, with a working steam pressure of 200 lbs.; heating surface, 1,906.9 sq. ft.; 290 iron tubes, 2 in. in diameter and 11 ft. 4⅝ in. long; carbon steel fire-box, 114 in. long and 42 in. wide; grate area, 33.25 sq. ft.; tank capacity, 6,000 gallons of water and coal capacity, 10 tons. The Atlantic locomotives will weigh 185,000 lbs., with 100,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 79 in.; wagon-top boilers, with a working steam pressure of 220 lbs.; heating surface, 2,077 sq. ft.; 325 iron tubes, 2 in. in diameter and 16 ft. 4 in. long; carbon steel fire-box, 102 in. long and 65 in. wide; grate area, 46 sq. ft.; tank capacity 6,000 gallons of water, and coal capacity 12 tons. The 10-wheel locomotives will weigh 185,000 lbs., with 143,000 lbs. on the drivers; cylinders, 21 in. x 28 in.; diameter of drivers, 73 in.; wagon-top boilers, with a working steam pressure of 220 lbs.; heating surface, 2,792 sq. ft.; 325 iron tubes, 2 in. in diameter and 15 ft. 5 in. long; carbon steel fire-box, 120 in. long and 41 in. wide; grate area, 33.54 sq. ft.; tank capacity 6,000 gallons of water, and coal capacity 12 tons. The switching locomotives will weigh 143,000 lbs.; cylinders, 19 in. x 28 in.; diameter of drivers, 57 in.; straight boilers, with a working steam pressure of 190 lbs.; heating surface, 1,681.90 sq. ft.; 288 iron tubes, 2 in. in diameter and 10 ft. 10½ in. long; carbon steel fire-box, 108 in. long and 39⅝ in. wide; grate area, 32.45 sq. ft.; tank capacity, 4,500 gallons of water and coal capacity six tons. The special equipment for all includes: Westinghouse air-brakes for Atlantic, 10-wheel and switching locomotives; Wabash bell ringers, Franklin boiler lagging, Damascus brake-beams, Gould couplers, Pyle-National headlight for Atlantic and 10-wheel locomotives, Ohio injectors, Jerome piston and valve-rod packings, Ashton safety valves, Mudd sanding devices, Chicago sight-feed lubricators, Crosby steam gages, Gold steam heat equipment for mogul, Atlantic and 10-wheel locomotives and Standard driving wheel tires.

CAR BUILDING.

The Great Northern is in the market for five mail, five combination, five sleeping and three tourist cars.

The Cincinnati, Bluffton & Chicago is reported in the market for a number of flat and box cars. J. C. Curtis, Bluffton, Ind., is General Superintendent.

The Pennsylvania Lines West have ordered 2,125 steel

cars. This order will be divided as follows: 1,125 cars to the American Car & Foundry Co., and 1,000 to the Standard Steel Car Co.

The New York, Ontario & Western has ordered 50 refrigerator cars of 60,000 lbs. capacity and 250 box cars of 80,000 lbs. capacity from the American Car & Foundry Co. for May, 1904, delivery. All the cars will be 26 ft. 8 in. long, 9 ft. 1 in. wide over end sills and 8 ft. high from floor to car lines. The special equipment for both includes, Simplex bolsters and brake-beams, Westinghouse brakes, Lappin brake-shoes, Miner tandem draft rigging, McCord dust guards, journal boxes and journal-box lids, Kimble & Hoornbeek paint, Neponset roofs, Railway Steel-Spring Co.'s springs, diamond trucks and chilled cast-iron wheels.

The Canadian Pacific is planning to build 1,000 box cars of 60,000 lbs. capacity at its new Angus shops. The cars will be 36 ft. long, 8 ft. 6 in. wide, and 8 ft. high, all inside measurements. The special equipment will include: Simplex bolsters and brake-beams, Westinghouse air-brakes, Canadian Pacific brasses, Tower couplers, Jones side doors, Miner draft rigging, McCord journal boxes and lids, Chicago-Winslow improved roofs, Barber roller trucks and Canadian Pacific cast-iron wheels.

The Southern is about to order 1,800 ventilated and 1,200 plain box cars of 60,000 lbs. capacity. The cars will be 36 ft. long, 8 ft. 6 in. wide and 8 ft. high, all inside measurements. The special equipment will include: Metal bolsters and brake-beams, Westinghouse air-brakes, National Malleable Castings Co.'s door fastenings, Jones doors, Miner draft rigging, M. C. B. steel axles, brake-shoes, brasses, couplers, journal boxes and lids, Chicago-Winslow improved roofs, and Southern Railway standard arch-bar trucks.

BRIDGE BUILDING.

AKRON, OHIO.—Bids will soon be asked by the City Engineer for building an iron bridge at Mill and Exchange streets over the railroad tracks. J. A. Gehres is County Surveyor.

ALABAMA.—On March 30 a bill was introduced in the House of Representatives authorizing the County Commissioners of Dale and Houston counties, Alabama, to build a bridge over the Choctawhatchee River, between the two counties named.

ALLIANCE, OHIO.—The County Commissioners will build a bridge over the Mahoning River.

BRATTLEBORO, VT.—The Brattleboro & Whitehall R. R. bridge over West River has been carried away by ice. The structure was 150 ft. long.

BOSTON, MASS.—Bids are wanted April 11 by the Metropolitan Park Commission for building a pile bridge with masonry draw piers at Saugus River, Lynnway. Edwin B. Haskell is a member of the Commission.

CARTHAGE, TENN.—Residents are agitating the question of building a bridge at this place over the Cumberland River to cost about $50,000. The proposition is for the county to pay $15,000, the town $25,000, and the Tennessee Central R. R. $10,000.

CATONSVILLE, MD.—Residents have petitioned Baltimore County Commissioners to replace the bridge over Patapsco River at Orange Grove, which was destroyed by ice.

CHARLESTON, S. C.—Bids are wanted April 20 by William P. Cantwell, County Supervisor, for rebuilding the bridge and draw over Rantowles Creek.

CHATTANOOGA, TENN.—Plans are being made for building a bridge to carry both steam and electric roads with double track over the Tennessee River near Cameron Hill, at a cost of about $400,000.

CLEVELAND, OHIO.—Bids for building about 20 county bridges, recently opened, were all rejected, and new ones may soon be asked.

COLUMBUS, OHIO.—The bridges destroyed by recent floods in Franklin County—three large bridges over the Big Walnut, at Georgesville, over the Black Lick on Winchester Dyke and the canal bridge at Lockburn, with others—will cost about $100,000 to rebuild.

CORTLAND, N. Y.—An iron bridge will be built over the Tioughnioga River, for which bids will soon be asked by Roscoe Rowe.

DANVILLE, PA.—The Danville & Bloomsburg Electric Ry. Co. will soon award the contract for building its bridge over Fishing Creek near Bloomsburg.

DAYTON, OHIO.—The Board of Public Service has recommended that the Pittsburg, Cincinnati, Chicago & St. Louis be granted permission to rebuild its bridge at Bainbridge street.

EDINBURG, IND.—The large steel bridge of the Indianapolis, Columbus & Southern Traction Co. over the Blue River has been carried away by floods; loss about $12,000.

ENDICOTT, N. Y.—The Erie, it is reported, will build a steel viaduct with concrete piers 186 ft. long, to consist of three spans, one of 126 ft. and two of 30 ft. over its tracks.

GALVESTON, TEX.—The Southern Pacific, it is said, will build a viaduct over its tracks in the West End, at a cost of about $60,000.

GRAND RAPIDS, OHIO.—Bids are wanted, May 3, for building the Grand Rapids Bridge in Wood County, to consist of three spans 650 ft. long with concrete floor, to cost about $170,000.

GRANFORD, N. J.—The Board of Freeholders will be petitioned to build a bridge over the Rahway River to connect Prospect street with Miln street.

GREENBAY, WIS.—Bonds for $12,000 will be issued to build a bridge over the East River at Webster avenue.

JANESVILLE, WIS.—Bids are wanted April 29 by C. V. Keich, City Engineer, for building a steel, plate-girder bridge 242 ft. long over Rock River.

KEWAUNEE, WIS.—Bids will soon be asked by Mayor Charles Metzner for building an iron or steel swing bridge 268 ft. long.

MILWAUKEE, WIS.—A special election will be held to vote on the question of bonding the city for the following: for the right of way to build a viaduct over the Menominee Valley to connect Washington avenue on the west and south sides of the city, $420,000; to build a viaduct over the Menominee Valley and bascule bridges over the river and canal to connect Sixth street and First avenue, $435,000; to build a new steel bascule bridge over the Milwaukee River to connect Michigan street with Sycamore street, $125,000.

MINNEAPOLIS, MINN.—The Minneapolis, St. Paul & Sault Ste. Marie is negotiating with the County Commissioner for permission to build a new steel bridge over its tracks at Rice street.

NEW MILFORD, CONN.—Bids will soon be asked for building a single-span iron bridge to cost about $20,000 over the Housatonic River. Henry O. Norton, of Worcester, Mass., is the Supervising Engineer.

INDIANA.—Congress has passed the bill authorizing the Southern Indiana Railway to build a draw bridge over the Wabash River, in Vigo County.

NEWARK, N. J.—The Joint Committee on Bridges of Essex and Bergen counties opened bids March 31 for building the new bridge at Avondale. It is to be on stone and concrete abutments and piers, with a steel superstructure and a draw 200 ft. long with shore spans of 80 ft. and a 30-ft. roadway, with 6-ft. sidewalks. They recommend that the contract be awarded to the Dean, Schwiers & Sutton Company, New York, whose bid for a bridge with asphalt pavement was $105,287, and with block pavement, $104,787. The other bids were: F. M. Stillman Company, Jersey City, $105,700, $106,100; American Bridge Company, New York, $115,900, $117,400; Canton Bridge Company, Canton, O., $129,650, $129,990; Groton Bridge Company, Groton, N. Y., $135,700, $136,000; Cooper-Wigand-Cooke Co., Newark, $109,972, $111,122; F. R. Long Company, New York, $118,412, $118,000; Owego Bridge Company, Owego, N. Y., $135,000, $135,000; Berlin Construction Company, East Berlin, Conn., $134,000, $136,000; King Bridge Company, Cleveland, O., 120,600, $125,000; De Vogel & Collins, Passaic, $118,400, $117,800.

NEW HAVEN, CONN.—The Alderman have approved the Board of Public Works' recommendations and authorized the city to arrange with the town of Orange to build the bridge on Kimberly avenue over West river. It is to consist of three spans, the middle or channel span to have an opening of 45 ft.

ONTONAGON, MICH.—The Chicago, Milwaukee & St. Paul will build a bridge over the Ontonagon River, to cost about $75,000.

ORANGE, TEXAS.—The County Commissioners are having plans made for building a bridge over Cypress Bayou on the road to Echo; bids will soon be asked for.

OWENSBORO, KY.—It is reported that a large number of bridges have been carried away by floods, and the damage in Daviess County is estimated at $50,000.

READING, PA.—Bids are wanted April 12 by John F. Ancona, County Controller, for building a bridge over Maiden Creek at Zettlemoyers Ford, in Greenwich Township, the bids to be either for a steel truss superstructure with plank roadway or a steel girder superstructure with concrete roadway.

RICHELIEU, QUE.—The Central Vermont Bridge over the Richelieu River has been carried away by ice, the entire bridge, 710 ft. long, being destroyed.

RIVESVILLE, W. Va.—Both Houses of Congress have passed the bill authorizing the Buckhannon & Northern R. R. Co. to build a bridge over the Monongahela River. (Feb. 26, p. 151.)

SAYBROOK, CONN.—Both Houses of Congress have passed the bill authorizing the New York, New Haven & Hartford to build a new bridge over the Connecticut River.

SEATTLE, WASH.—The Secretary of War has approved the Northern Pacific's application to build a drawbridge over the Duwamish River.

SHREVEPORT, LA.—A bill was introduced in the House of Representatives on March 30, authorizing the Shreveport Bridge & Terminal Co. to build a bridge over the Red River, at or near Shreveport.

SUNBURY, PA.—The directors of the Northumberland Bridge Co., at a recent meeting, decided to replace with a steel structure the bridge recently carried away by flood.

TERRE HAUTE, IND.—On March 28 the United States Senate passed a bill authorizing the County Commissioners of Vigo County, Ind., to build and maintain a wagon, foot and electric car bridge over the Wabash River, at the foot of Wabash Ave., in Terre Haute, Ind.

WASHINGTON, D. C.—A bill has been introduced in the United States Senate authorizing the Wabash R. R. to build bridges over the Chesapeake & Ohio canal on the line of its proposed extension to the Seaboard.

WATERVILLE, OHIO.—Bids are wanted, May 10, for building a bridge at Waterville in Lucas County, to cost about $28,000.

YANKTON, S. DAK.—Congress has passed the bill authorizing the Winnipeg, Yankton & Gulf Railroad to build a bridge over the Missouri River, near Yankton. (Feb. 5, p. 104.)

Other Structures.

ALAMEDA, CAL.—The Southern Pacific, it is reported, has plans ready for building a new passenger station.

ARKANSAS CITY, KAN.—An agreement, it is reported, has been reached between the city and the Kansas-Oklahoma Interurban R. R. for the latter to build its machine shops, terminals, yards, power houses and general offices of the road at this place, the city agreeing to give the land required to the company.

BEAUMONT, TEX.—The Southern Pacific, it is reported, has plans ready and will begin work at once on a new brick passenger station.

BELLINGHAM, MINN.—The Great Northern will build at once a new brick passenger station 120 ft. long and 22 ft. wide.

CAMPBELLTON, N. B.—It is reported that the Intercolonial Railway will build a new station.

CHENOA, ILL.—A new passenger station of brick and stone, 135 ft. long, is to be built at this place.

CINCINNATI, OHIO.—Bids are wanted April 23 by the Cincinnati Southern for building a new freight house, which is to be 510 ft. long and 35 ft. wide, of corrugated iron.

COLUMBIA, S. C.—The Southern, it is reported, will remodel and enlarge its shops, doubling their present capacity, and build a new roundhouse with 16 stalls, at a cost of about $40,000.

DENISON, TEXAS.—The Missouri, Kansas & Texas, the Houston & Texas Central and the St. Louis & San Francisco, it is reported, will jointly build a union passenger station.

DURHAM, N. C.—The Durham Union Station Co. has been incorporated with a capital of $25,000 to build a union passenger station at Durham for the use of the Seaboard Air Line, the Southern and the Norfolk & Western. Henry W. Miller, of Raleigh, is one of the incorporators.

MILACA, MINN.—The Great Northern, it is reported, will build a brick passenger station, to cost $20,000.

NIAGARA FALLS, N. Y.—The Central Machine Company will put up a building two stories high, 60 ft. x 120 ft., to cost $10,000.

OKLAHOMA CITY, OKLA. T.—It is reported that the Rock Island and the St. Louis & San Francisco interests will jointly build a union passenger station to cost about $150,000.

PHILADELPHIA, PA.—The Pennsylvania, it is reported, will build a large freight shed at the junction of the Philadelphia, Baltimore & Washington and the Greenwich branch, and large freight yards on the land bounded by Twenty-third, Twenty-fifth and Ellsworth streets and Washington avenue.

PINE BLUFF, ARK.—The Iron Mountain, it is reported, has agreed to build a $50,000 passenger station if a suitable site can be obtained.

SAN ANTONIO, TEXAS.—The International & Great Northern, it is reported, will build a new passenger station and terminals at a cost of about $125,000.

SEDALIA, MO.—The Missouri Pacific, it is announced, will build its general shops at Sedalia. The city is to pay a bonus of $180,000 and donate land of 120 acres. The total cost of the shops will be about $1,000,000.

SHAWANO, WIS.—The Northwestern, it is reported, will build a new passenger station at the foot of Main street on land given by the city.

SPARTANBURG, S. C.—The Southern, reports say, has appropriated $75,000 for building a new passenger station on which work is to begin June 1.

TOYAH, TEX.—The Texas & Pacific will rebuild its roundhouse recently destroyed by fire.

WILMINGTON, DEL.—The Philadelphia, Baltimore & Washington, it is reported, has plans ready for building new freight sheds on the north side of Third street to connect with those at Fourth and Pine streets.

RAILROAD CONSTRUCTION.

New Incorporations, Surveys, Etc.

ARIZONA EASTERN.—This company has been incorporated in Arizona to build a railroad from Yuma east to Clifton, approximately 350 miles. E. S. Ives, Yuma, Ariz.; R. R. Coleman, Prescott, Ariz., and others are incorporators.

ARIZONA SOUTHERN.—An officer writes that the proposed route of this road is from Red Rock, Ariz., south to the mines of the Imperial Copper Co., at Silverbell, 21 miles. Grading was begun on Feb. 17, and it is expected that it will be completed by May 15, 1904. Track laying has just been begun. The contractors are the Grant Bros. Construction Co., Los Angeles, Cal. The work is heavy. The maximum grade will be 3.4 per cent. and the maximum curvature 15 degrees. The road will be standard gage and will be laid with 50-lb. rails. There will be no important bridges and no tunnels. E. B. Gage Tombstone, Ariz., is President, and W. F. Staunton General Manager. (See Construction Supplement.)

BATON ROUGE & NORTHEASTERN.—This company has been organized in Louisiana to build a railroad from Baton Rouge, La., northeast to Grangeville, 30 miles. It is stated that rights of way are now being secured and that preliminary surveys will shortly be begun. R. A. Hart is President, and J. L. Westbrook, Secretary, both of Baton Rouge, La.

BLUEFIELD & WIDEMOUTH (ELECTRIC).—An officer writes that the proposed route of this road is from Bluefield, W. Va., through Ormiston to Widemouth, 18 miles. Grading is now in progress between Graham and Bluefield, 3½ miles, by the contractors, Long & Bryan, of Bluefield.

BUTTE COUNTY.—Press reports state that grading on this new line from Chico, Cal., north through Paradise, Magalia and Coutolene to Sterling, Cal., 32 miles, has been completed and track laying will be begun at once. Steele Bros., of Oakland, Cal., are the contractors. (See Construction Supplement.)

CHERRY TREE & DIXONVILLE.—It is reported that this company will let contracts in a few days for a further extension of its line. The road runs at present from Cherry Tree, Pa., to Possum Glory, 21 miles. It is owned jointly by the Pennsylvania and the New York Central & Hudson River. Connection is made at Cherry Tree with both the Cambria & Clearfield and the Pittsburg & Eastern. The line extends into a bituminous coal region and taps a large number of soft coal mines.

CHICAGO & NORTH WESTERN.—Press reports state that surveys are now in progress for a cut-off which will save 17 miles between Omaha and Chicago. The work will include about 40 miles of new double track and the rebuilding of about 30 miles. The line to be rebuilt extends from Carroll, Iowa, to Harlan, and the new line from Council Bluffs to Harlan, 40 miles. It is reported that work will be begun as soon as the surveys have been completed.

Press reports state that this company will build new yards at Melrose Park, 12 miles west of Chicago, to relieve the present congestion. It is stated that $500,000 will be spent on the work.

CRYSTAL RIVER.—Incorporation has been granted this company in Florida to build a railroad from Crystal, in Citrus County, northeast to Dunnellon, 15 miles. W. N. Camp is President and R. C. Camp, General Manager, both of Ocala, Fla.

COAL & COKE.—A contract for 15 miles of this road out of Elkins, W. Va., has been let to the Smith Construction Co., of Philadelphia. W. H. Bower, Elkins, W. Va., is General Manager.

DELAWARE & HUDSON.—An officer writes that nothing definite has as yet been decided about equipping this company's line with the third-rail electric system between Carbondale and Wilkesbarre, Pa. The question of the electrification of the Pennsylvania division has been given serious consideration and several additional tracks will probably be built in the near future in that territory.

DOMINION & GULF.—See Kansas Central, Oklahoma & Gulf below.

FOND DU LAC & NORTHWESTERN.—This company has increased its capital stock from $10,000 to $750,000. It is proposed to build a railroad from Madison, Wis., to Fond du Lac. W. H. Phillips is President, and may be ad-

dressed at Fond du Lac, Wis. (See Construction Supplement.)

Fort Smith, Indian Territory & Texas.—A charter has been granted this company in Arkansas. It is proposed to build from a point near Forth Smith in a southwesterly direction through Sebastian County to Cedars, Ind. T., and thence through the Choctaw nation to a point on the boundary line of Texas. J. F. Nelson, T. C. Davis, G. T. Sparks, J. F. Reed and others, of Fort Smith, Ark., are incorporators.

Grand Valley, Colorado River & Southern Pacific.—Press reports state that this company has been incorporated to build a railroad in Colorado and Utah. The proposed route is not stated. G. R. Proffer, Basin, Utah, may be addressed.

Great Falls & Old Dominion (Electric).—The United States Senate Committee on the District of Columbia has favorably reported a bill authorizing this new electric railroad to enter District of Columbia over the Aqueduct bridge and to run in an easterly direction through the city of Washington on M St., from the northern end of the Aqueduct bridge at Thirty-sixth St. to the Union railroad station. (See Construction Supplement.)

Guelph & Goderich.—A charter is being asked by this company from the Dominion Parliament to build a railroad from Guelph Junction west to Goderich, 85 miles, with branches to Listowel, St. Marys and Clinton. It is proposed to take over the rights and franchises of the Guelph Junction R. R. E. N. Lewis, Goderich, and A. H. MacDonald, Guelph, Ont., are interested.

Gulf & Pacific.—A charter has been granted this company in Texas to build a railroad from Velasco to Paris, with two branch lines, a total length of about 500 miles. The names of the incorporators are not stated.

Hammond Belt R. R.—Incorporation has been granted this company in Illinois. It is proposed to build a belt line from a point near the city of Hammond, Ind., in a northwesterly direction to Calumet Park, in Cook County, Ill. A. F. Knott and P. W. Meyer, Hammond, Ind.; J. J. Healy and W. E. Taylor, Chicago, Ill., are incorporators.

Kansas Central, Oklahoma & Gulf.—The directors of this company have filed an amendment to the charter changing the name of the company to the Dominion & Gulf and increasing the capital stock from $20,000,000 to $50,000,000. The proposed route of the road is from Enid, Okla. T., south to New Orleans, La. and Galveston, Texas. F. C. Spaulding, Kansas City, Mo.; J. A. Koontz, Hutchinson, Kan.; J. H. Ledgerwood, Guthrie, Okla. T., and others are incorporators. (See Construction Supplement.)

Keeseville, Ausable Chasm & Lake Champlain.—This company has completed its plans for changing its line into a third-rail electric railroad. The road extends from Port Kent, Essex County, N. Y., to Keeseville, six miles, and is used chiefly to supply freight facilities for pulp and paper mills along the Ausable River. Connection is made with the Delaware & Hudson and with the Lake Champlain steamers. It is stated that the work of changing the line will be begun at once.

Kohala & Hilo.—An officer writes that this company will soon begin work on a branch line 15 miles long from Hilo to Hakalau. The work will include several steel trestles from 40 to 100 ft. in height. Robert Hawxhurst, Jr., Hilo, Hawaiian Islands, is Chief Engineer.

Lake Erie & Fort Wayne.—Articles of incorporation have been filed by this company in Indiana. It is proposed to build a railroad 25 miles long in Allen County, beginning at the plant of the Fort Wayne Iron & Steel Co., and running around the city of Fort Wayne. H. G. Rockhill, C. H. Rawlins, P. A. Randall, W. J. Vesey and others, of Fort Wayne, Ind., are incorporators.

Lake Erie & Western.—This company has been organized in Ohio to build a railroad from Lorain through Medina, Summit, Portage and Mahoning counties to a point on the state line on the Mahoning River. W. H. Park is President; John Stambaugh, Vice-President, and W. F. Ritter, Secretary. It is reported that this is a Pittsburg & Lake Erie project.

Louisville & Nashville.—Track laying is in progress on the Cane Creek branch of this road. A length of only about 12 miles between Mineral Springs, Ala., and Littleton is left to be laid, and it is stated that the road will be finished by April 15.

This company will soon begin work on an extension of its Lumberton branch. This extension was authorized at a recent meeting of the Board of Directors. The new line will run from the present terminus of the Lumberton branch into the northern part of Clay County for a distance of 14 miles.

Maywood & Sugar Creek.—This company has been incorporated in Missouri to build a line from Maywood, on the Kansas City Southern to a connection with the Atchison, Topeka & Santa Fe, a distance of 2 miles. T. T. Crittenden, W. J. Clark and others are incorporators.

Mexican Roads.—The Mexican Government has granted a concession to E. C. Creel and C. I. Graves, of Chihuahua, Mex., for building a number of railroad lines in Northwest Mexico. The principal line is to run from a point near El Carpio through Casa Blanca and Matachic to Temosachic.

A contract has been awarded to Melville & Kelly, Saltillo, Mex., for building a railroad from Linares to the San Jose mines, 38 miles. Work will be begun at once, and it is stated that the line will be completed before the end of the year. E. R. Self, Linares, Mex., is interested.

Minnesota & Great Northern.—This company has been incorporated in Minnesota with an authorized capital of $2,000,000. It is proposed to build from Pelican Rapids, Minn., north through Ottertail, Norman and Polk into Roseau County. It is stated that this road is a Great Northern project. L. W. Hill, R. A. Wilkinson and other Great Northern officers are incorporators.

Missouri, Kansas & Texas.—It is stated that a contract for building an extension from Coalgate, Ind. T., to Denison, Texas, over the old Denison & Wichita Valley survey is to be let on April 10. J. W. Petheram, Dallas, Texas, is Chief Engineer.

Nacozari.—It is officially announced that the extension of this road from Cos, in the State of Sonora, Mex., to Nacozari, 20 miles, will be completed by May 15 and that the line will immediately be extended south to Montezuma, a distance of 56 miles. J. S. Douglass, Nacozari, is President. (See Construction Supplement.)

New Jersey Short Line.—Incorporation has been granted this company in New Jersey with an authorized capital of $3,000,000. The proposed route of the road is not stated. R. I. Ashbridge, East Downington, Pa.; T. B. Curley, and J. H. Switzer, Camden, N. J., and others are incorporators.

New York Central & Hudson River.—The following contracts for grading on the Pennsylvania division have been awarded: extension of siding at Ramsey; double tracking, including Marsh Creek grade revision, from Leach to Ansonia; double tracking from Wentz to Watkins, and siding and revision of line at Presho; contractors, Charles A. Simms & Co. Double tracking from Ansonia to Tiadaghton, Pa., storage tracks at Corning and side tracks at Pine; contractors, the Miller Construction Co., of Madera, Pa.

New York, Philadelphia & Norfolk.—It is reported that this company will soon begin work on a second track between Cape Charles, Va., and Delmar, a distance of 95 miles.

Norfolk & Southern.—An officer writes confirming the report that a contract has been awarded to Jones, Luck & Co., of Roanoke, Va., for building a branch line from Mackey's Ferry to Plymouth, N. C., a distance of 10 miles. Connection will be made at the latter point with the Pamlico Division of the Washington & Plymouth, which was recently bought by this company. About 2½ miles of grading has been completed and it is expected that the branch will be finished about July 1, 1904. F. I. Nicholson, Norfolk, Va., is Chief Engineer. (March 18, p. 222.)

Northern Pacific.—The Yacolt branch of the Pacific division has been opened for traffic from Vancouver Junction, Wash., north to Yacolt, 27 miles.

Oakland, Charleston & Western.—An officer writes that work will be begun and contracts will be let within 30 days for building this proposed road from Oakland, Miss., southwest to Charleston, 12 miles. Connection will be made with the Illinois Central at Oakland. The offices of the company will be at Charleston. J. H. Larimer, Ingalls Building, Indianapolis, is President, and Butler Smith is Chief Engineer. (March 18, p. 222.)

Overton County.—The contract has been awarded to the Southern Construction Co. to build this railroad. When completed, the main line, with branches running to several coal mines in Overton County, will be about 100 miles in length. J. A. Hargrove, G. W. Dillon and others, of Livingstone, Tenn., are incorporators. (April 27, p. 264.)

Petaluma & Santa Rosa (Electric).—A contract has been awarded to C. M. Warren, San Francisco, Cal., for building this electric railroad from Petaluma, Cal., through Santa Rosa to Sebastopol, 16 miles. L. M. Hall is Chief Engineer and J. A. McNear, President, both of Petaluma, Cal. (See Construction Supplement.)

Red River & Southwestern.—Press reports state that work will soon be resumed on this road from Henrietta, Tex., to Abilene, 135 miles. About 30 miles of this line, from Henrietta to Archer City, were graded a number of years ago; $200,000 in bonuses have been received by the company and their rights of way have been practically all secured. M. J. Healy is General Manager and F. C. Hand, Chief Engineer, both of Henrietta.

Rochester, Scottsville & Caledonia (Electric).—This company is about to be organized in New York State to build an electric railroad from Rochester southwest through Scottsville to Caledonia, 25 miles. J. F. Alden, H. C. Brewster, A. H. Brown and others of Rochester are said to be interested.

St. Louis, Brownsville & Mexico.—It is reported that this road is graded to within 36 miles of Brownsville, Tex. This makes a total of 105 miles graded and 95 miles of track laid. Cars will probably be running into Brownsville by June 1. F. G. Jonah, Corpus Christi, Tex., is Chief Engineer. (See Construction Supplement.)

St. Maurice Valley.—Application is being made at the present session of the Dominion Parliament for an act to incorporate this company to build from Three Rivers, Que., to St. Jean des Piles, in the county of Champlain, and thence in a northwesterly direction to Mattawin River, where connection will be made with the Transcontinental Railway. Tourigny & Bureau, of Three Rivers, are acting for the promoters.

San Pedro, Los Angeles & Salt Lake.—A press despatch from California states that the work on this proposed road from Calientes, Nev., to Daggett, Cal., 130 miles, is progressing rapidly. Grading has been completed for a distance of 50 miles out of Daggett and tracklaying is in progress. The Mojave tunnel is about 40 per cent. completed and the Kessler summit line, 34 miles, is entirely graded. The despatch states that the company has 650 men working on the California end of the line and that the hardest part of the work has been completed. The highest elevation on the Kessler summit line is 4,200 ft. and work is completed to within a short distance of this point. The Utah Construction Co., of Salt Lake, has the contract for building the road.

Sioux Falls & Colton.—This company has been organized in South Dakota to build a railroad from Sioux Falls northwest for a distance of 20 miles. It is stated that the line will eventually be extended to Madison, 40 miles from Sioux Falls. P. F. Sherman, Sioux Falls, is said to be interested.

Tennessee Central.—The Crawford branch has been extended from Crawford, Tenn., to Wilder, seven miles. It will connect with the coal properties of the Fentress Coal & Iron Co., in Fentress County, Tenn. (See Construction Supplement.)

Tombigbee Valley.—The following information has been received by the *Manufacturers' Record* from an official of this railroad: "The Tombigbee R. R. has purchased the Tombigbee & Northern, located in Washington and Mobile counties, Ala. This is now a standard road with 40 miles of main line and 13 miles of spur track. No immediate extension of the line is contemplated, but several minor improvements will be made and the equipment will be made standard gage and will be added to."

GENERAL RAILROAD NEWS.

Brunswick & Birmingham.—At a meeting of the stockholders of this company on March 29 the sale of the property and franchises of the Brunswick & Birmingham R. R. to the Atlantic & Birmingham was ratified. The former road is now operated as a division of the Atlantic & Birmingham, the new arrangement having gone into effect April 1.

Chicago & Oak Park Elevated.—See Lake Street Elevated below.

Delaware & Hudson.—It has been officially announced that the recent offer to the stockholders of this company of the privilege of subscribing to a new issue of stock amounting to $7,000,000 has been successful and that the entire issue has been taken by the stockholders. The new stock is to be issued at $135 per share.

Fort Wayne & Wabash Valley.—This company has filed a mortgage for $7,500,000 with the North American Trust Co., of Philadelphia, as trustee. The purpose of the mortgage is not stated.

Grand Trunk.—An officer of this company estimates that the losses due to the heavy snows and severe weather of the past three months amount to $1,300,000, of which $300,000 represents the cost of the removal of snow and $1,000,000 the falling off in freight and passenger receipts. In view of these losses retrenchment has been ordered on all divisions and a large number of employees have been laid off. At the shops at Stratford, Ont., the force of 900 men has been reduced to about 700. By July 1, the officers hope to have the shops again working with their full forces.

Interborough Rapid Transit (New York City.)—It has been announced that, owing chiefly to troubles with workmen, the subway will not be opened in June, which was lately given out as the probable date, but that it will probably be ready for operation in the fall of 1904.

Knoxville, La Follette & Jellico.—At a meeting of the stockholders of this company on April 5, it was voted to sell the road to the Louisville & Nashville. This line was recently completed from Nashville, Tenn., to Knoxville, and will form a connecting link between Cincinnati and Knoxville.

Lake Street Elevated.—The stockholders of this company have voted to change the name to the Chicago & Oak Park Elevated. The Lake Street Elevated was organized in 1892, but has been in the hands of a receiver for the last two years. The road owns 10 miles of double track, with 2½ miles of siding.

Louisville & Nashville.—See Knoxville, La Follette & Jellico, above.

Mobile & Ohio.—This company has sold to Blair & Co., New York, $2,200,000 of car trust certificates bearing 5 per cent. interest. The heavy traffic which this company has been called upon to handle during the past year has necessitated a large amount of new cars and engines. The following orders have recently been placed: 625 box cars, 75 hopper bottom gondolas and 500 drop-end gondolas from the American Car & Foundry Co.; 275 box cars, 200 drop-end gondolas, 150 stock cars and 75 hopper-bottom gondolas from the Mt. Vernon Car Mfg. Co., and 20 locomotives from the Baldwin Locomotive Works.

New York, New Haven & Hartford.—President Mellen, in outlining his plans for the development of electric railroads in and about New Haven, has announced that a through electric service will shortly be established between New Haven and Waterbury. For several years a trolley line has run from New Haven to Mount Carmel, and last year it was extended as far as Cheshire. It is now proposed to build a connecting link from Cheshire to Waterbury, a distance of about eight miles. This line will pass to the south of the existing steam line between these points. In speaking of the policy of the company, President Mellen says in part: "So far from attempting to smother the trolley road in any way, the policy will be to develop the trolley system to the fullest extent possible disregarding the interests of the steam lines in the territory in which the two roads operate."

Pennsylvania Company.—The company's bankers, Kuhn, Loeb & Co., of New York City, have received the whole of the loan of $50,000,000, which was negotiated by an issue of notes in February and which was payable on April 2. It is understood that the money will be held on deposit in New York banks for a time, in order not to disturb the money market, and that it will be withdrawn gradually according to the company's needs. The loan is for 18 months, the company paying 4½ per cent. for the use of the money and an additional commission, which will make the total cost about 5 per cent. The notes are in four series of different denominations, viz.: series A, numbers 1 to 2,000, $5,000 each; series B, numbers 2,001 to 3,000, $10,000 each; series C, numbers 3,001 to 3,600, $25,000 each; series D, numbers 3,601 to 3,900, $50,000 each. The collateral deposited with the Fidelity Trust Co., of Philadelphia, as trustee, to secure these notes consists of preferred and common stock of the Baltimore & Ohio; Chesapeake & Ohio; Norfolk & Western; Pittsburg, Cincinnati, Chicago & St. Louis; Philadelphia, Baltimore & Washington; Northern Central, and the Pittsburg, Fort Wayne & Chicago (guaranteed special stock) railroads. The total par value of the collateral deposit amounts to approximately $84,000,000.

Queen Anne's R. R.—The holders of the majority of the stock of this company have signed an agreement granting an option until April 15, on this stock to N. P. Bond, of Baltimore, and H. P. Scott, of Wilmington. It is stated that the road will be bought by the Pennsylvania.

Railroad Franchise Taxation in New York.—The New York State Board of Tax Commissioners has announced the final valuations of special franchises in New York City for 1904. These valuations amount to $251,521,450; in 1903 the total was $235,142,825. The valuations placed on franchises of the street railroads in the city are as follows:

	1904.	1903.
Brooklyn City R. R.	$12,685,000	$12,502,000
Brooklyn Union Elevated	5,984,000	6,125,000
Broadway & 7th Ave.	6,540,000	6,540,000
Metropolitan Street Ry.	18,480,000	18,413,000
Third Avenue Railroad	10,300,000	10,310,000
Manhattan Elevated	50,075,000	47,100,000

Tonopah R. R.—This company has filed a mortgage for $750,000 with the Philadelphia Title & Trust Co. as trustee. Bonds will be issued to the above amount, bearing 6 per cent. interest. The road is projected from Tonopah, Nev., to Rhodes, 63 miles, and grading is now in progress by the contractors, McClain & McSweeney. Paul Inglehart, Tonopah, Nev., is Chief Engineer.

Wilmington, Newcastle & Southern.—This company has been organized in Delaware to take over the properties and franchises of the Wilmington & Newcastle and the Newcastle & Delaware railroad companies. The authorized capital stock of the new company is $330,000, of which $170,000 is preferred and $160,000 common stock. H. L. Evans is President and F. R. Morrison Treasurer, both of Wilmington, Del.